GARMIN

G3X

Installation Manual

Garmin International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
Aviation Dealer Technical Support Line (Toll Free): (888) 606-5482
www.garmin.com

Garmin (Europe) Ltd
Liberty House
Bulls Copse Road
Hounsdown Business Park
Southampton, SO40 9RB, UK
Telephone: +44 (0) 8708501241

RECORD OF REVISIONS

Revision	Revision Date	Description
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WARNING

This product, its packaging, and its components contain chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. This Notice is being provided in accordance with California's Proposition 65. If you have any questions or would like additional information, please refer to our web site at www.garmin.com/prop65.

NOTE

The Garmin G3X system includes products like the GDU 37X and the GSU 73 that are not TSO-certified products and have received no FAA approval or endorsement. Consequently the G3X system is not suitable for installation in type-certificated aircraft.

NOTE

Unless otherwise noted all installation guidance, requirements, and instructions apply to one-display, two-display, and three-display G3X systems.

NOTE

References to the GDU 37X throughout this manual apply equally to the GDU 370 and GDU 375 except where specifically noted.

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Limited Warranty for Garmin GMU 44 and GTP 59 Products

The Garmin products GMU 44 and GTP 59 are warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within this period, Garmin will at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

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Garmin International, Inc.
1200 East 151st Street
Olathe, Kansas 66062, U.S.A.
Phone: 913/397.8200
FAX: 913/397.0836

Garmin (Europe) Ltd.
Liberty House, Bulls Copse Road
Hounsdown Business Park
Romsey, SO40 9RB, U.K.
Phone: +44/ (0) 870.8501241
Phone: +44/ (0) 870.8501251

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Phone: +44/ (0) 870.8501241
Phone: +44/ (0) 870.8501251

GSU 73 HARDWARE MOD LEVEL HISTORY

The following table identifies hardware modification (Mod) Levels for the GSU 73 LRU. Mod Levels are listed with the associated service bulletin number, service bulletin date, and the purpose of the modification. The table is current at the time of publication of this manual (see date on front cover) and is subject to change without notice.

MOD LEVEL	SERVICE BULLETIN NUMBER	SERVICE BULLETIN DATE	PURPOSE OF MODIFICATION
1	N/A	N/A	Improved HSCM accuracy when using +28V supply

1 G3X Installation Overview

1.1 Unpacking Unit

Carefully unpack the equipment and make a visual inspection of the unit for evidence of damage incurred during shipment. If any component of the G3X system is damaged, notify the carrier and file a claim. To justify a claim, save the original shipping container and all packing materials. Do not return the unit to Garmin until the carrier has authorized the claim.

Retain the original shipping containers for storage. If the original containers are not available, a separate cardboard container should be prepared that is large enough to accommodate sufficient packing material to prevent movement.

1.2 Introduction

This manual provides all of the mechanical and electrical information required for the installation of the G3X system.

NOTE

The Garmin G3X system includes products like the GDU 37X and the GSU 73 that are not TSO-certified products and have received no FAA approval or endorsement. Consequently the G3X system is not suitable for installation in type-certificated aircraft.

The following outline describes the organization of this manual:

Section 1	This section contains a basic overview of the G3X system and interface. A Block diagram is given to aid in the understanding of the system. This section also contains generic information that pertains to all components of the G3X system, such as mounting, wiring, and antenna location.
Section 2	This section describes the mechanical, electrical, and installation aspects of the GDU 37X.
Section 3	This section describes the mechanical, electrical, and installation aspects of the GMU 44.
Section 4	This section describes the mechanical, electrical, and installation aspects of the GSU 73.
Section 5	This section describes the mechanical, electrical, and installation aspects of the GTP 59.
Section 6	This section describes the mechanical, electrical, and installation aspects for the GPS and XM antennas.
Section 7	This section describes the non-G3X LRU interfaces.
Section 8	This section contains software, configuration, database, and XM activation information.
Section 9	This section contains post-installation checkout and calibration procedures for the G3X.
Section 10	This section contains G3X troubleshooting information.
Section 11	This section contains information for ensuring the unit is suitable to be returned to service.
Appendix A	This section contains pinout information for all G3X LRU's.
Appendix B	This section contains connector installation instructions.
Appendix C	This section contains G3X Outline and Installation Drawings.
Appendix D	This section contains the G3X Interconnect Drawings.
Appendix E	This section contains the G3X External Interface Drawings.

1.3 System Overview

The G3X is an advanced technology avionics suite designed to integrate pilot/aircraft interaction into one central system. The system combines primary flight instrumentation, aircraft systems instrumentation, and navigational information, all displayed on one, two, or three color screens. The G3X system is composed of several sub-units or Line Replaceable Units (LRUs). LRUs have a modular design and can be installed directly behind the instrument panel or in a separate avionics bay if desired. This design greatly eases troubleshooting and maintenance of the G3X system. A failure or problem can be isolated to a particular LRU, which can be replaced quickly and easily. Each LRU has a particular function, or set of functions, that contributes to the system's operation. For additional information on LRU functions, see the applicable section of this manual.

1.3.1 System Architecture

Figure 1-1 illustrates an example block diagram of a G3X installation. The flexibility of system allows the installer to determine the architecture that best fits each installation.

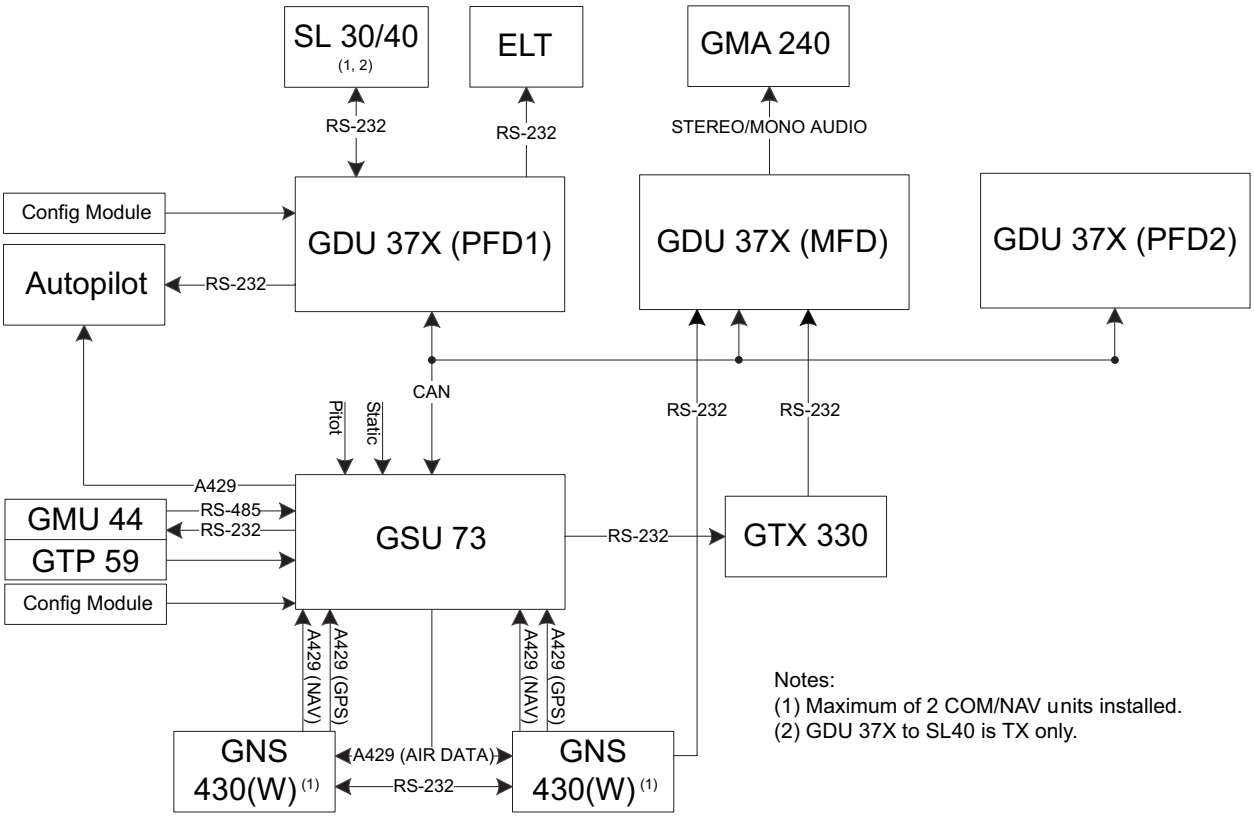


Figure 1-1. G3X Interconnect Example

1.4 General G3X LRU Specifications

1.4.1 Garmin LRU Part Numbers

Table 1-1. G3X LRU Part Numbers

LRU	Unit Only Part Number	Assembly Part Number
GDU 370 Americas DB	011-01747-15	010-00667-15
GDU 370 Atlantic DB	011-01747-20	010-00667-20
GDU 370 Pacific DB	011-01747-35	010-00667-35
GDU 375 Americas DB	011-01747-30	010-00667-25
GMU 44	011-00870-10	010-00296-10*
GSU 73	011-01817-00	010-00691-00*
GTP 59	011-00978-00*	NA

*Included in G3X LRU Kit (K10-00016-00)

Table 1-2. Contents of GDU 37X Assembly (010-00667-XX)

Item	Garmin P/N	Quantity
GDU 37X	011-01747-XX	1
GDU 37X Connector Kit	011-01921-00	1
GDU 37X Nutplate	115-01054-00	1
SD Card, Dummy	145-00561-00	1
Important Safety and Product Information	190-00720-50	1
GDU 37X Quick Reference Guide	190-01055-00	1
Jeppesen Free Single Update	190-10003-03	1

1.4.2 Power Specifications

All LRUs are capable of operating at either 14 or 28 VDC. Table 1-3 lists current draw specifications.

Table 1-3. G3X LRU Power Requirements

LRU	Supply Voltage	Current Draw
GDU 37X	10-29 Vdc	1.10 Amp @ 14Vdc 0.55 Amp @ 28Vdc
GMU 44	12Vdc (from GSU 73)	Inc. in GSU Current Draw
GSU 73	10-29 Vdc	1.75 Amp @ 14Vdc (Max) 0.80 Amp @ 28Vdc (Max)

1.4.3 Physical Specifications

All width, height, and depth measurements are taken with unit rack (if applicable) and connectors.

Table 1-4. G3X LRU Physical Specifications

LRU	Width	Height	Depth (GMU 44 Diameter, including flange*)	Unit Weight	Unit Weight w/Nutplate & Connector Weight
GDU 370	6.04 inches (153.4 mm)	7.83 inches (198.8 mm)	3.41 inches (86.7 mm)	1.6 lbs (0.713 kg)	1.8 lbs (0.803 kg)
GDU 375	6.04 inches (153.4 mm)	7.83 inches (198.8 mm)	3.41 inches (86.7 mm)	1.7 lbs (0.753 kg)	1.9 lbs (0.843 kg)
GMU 44	N/A	2.10 inches (5.33 cm)	*3.35 inches (85.1 mm)	0.35 lbs. (0.16 kg)	0.50 lbs. (0.23 kg)
GSU 73	5.50 inches (139.8 mm)	3.96 inches (100.6 mm)	7.33 inches (186.2 mm)	3.1 lbs (1.41 kg)	3.5 lbs (1.59 kg)

1.4.4 Cooling Requirements

While no forced cooling air is required for the G3X system, it is highly recommended that the air behind the panel be kept moving (by ventilation or a fan).

- No cooling air is required for the GDU 37X
- No cooling air is required for the GMU 44
- No cooling air is required for the GSU 73, however the GSU 73 should be mounted in a location that provides adequate airflow to comply with the maximum outer case temperature listed in Section 4.

NOTE

Avoid installing the G3X LRUs near heat sources. If this is not possible, ensure that additional cooling is provided. Allow adequate space for installation of cables and connectors. The installer will supply and fabricate all of the cables. All wiring should be in accordance with FAA AC 43.13-1B and AC 43.13-2A.

1.5 Installation Requirements

One GDU 37X assembly (listed in Table 1-1) is required, dependent upon customer's desired database region. Each GDU 37X (010-00667-XX) comes with all equipment needed for installation.

1.5.1 Required Accessories

The following kits are required for the installation of the G3X.

Table 1-5. Contents of G3X Installation Kit (K10-00017-00)

Item	Garmin P/N	Quantity
GMU 44, Connector Kit	011-00871-00	1
Config Module w/EEPROM, Jackscrew	011-00979-20	1
Config Module w/Sockets, Jackscrew	011-00979-22	1
Thermocouple Kit	011-00981-00	1
GSU 73, Connector Kit, P9731	011-01818-00	1
GSU 73, Connector Kit, P9732	011-01818-01	1
G3X, Supplemental Parts	011-02347-00	1
GMU 44, Install Rack, Modified	115-00481-10	1

Table 1-6. Contents of G3X LRU Kit (K10-00016-00)

Item	Garmin P/N	Quantity
GMU 44, Unit Only	010-00296-10	1
GSU 73, Unit Only	010-00691-00	1
GTP 59, Unit Only	011-00978-00	1

1.6 Mounting

Refer to Section 2 through Section 6 for specific mounting instructions for each component of the G3X, and to Appendix A for Outline & Installation Drawings.

1.7 Wiring/Cabling Considerations

Use MIL-W-22759/16 (or other approved wire) AWG #24 or larger wire for all connections unless otherwise specified. The supplied standard pin contacts are compatible with up to AWG #22 wire. In cases where some installations have more than one LRU sharing a common circuit breaker, sizing and wire gauge is based on aircraft circuit breaker layout, length of wiring, current draw on units, and internal unit protection characteristics. Do not attempt to combine more than one unit on the same circuit breaker.

RG400 or RG142 coaxial cable with 50 Ω nominal impedance and meeting applicable aviation regulations should be used for the installation.

1.7.1 Wiring Harness Installation

Allow adequate space for installation of cables and connectors. Ensure that routing of the wiring does not come in contact with sources of heat, RF or EMI interference. Analog Input wires routed too close to spark plugs, plug wires, or magnetos may result in erratic readings.

The installer shall supply and fabricate all of the cables. Required connectors, etc. are provided with the G3X Installation Kit (K10-00017-00). Electrical connections are made through D subminiature connectors for the GDU 37X and GSU 73 units, and through a round 9-pin connector for the GMU 44. Appendix A defines the electrical characteristics of all input and output signals. Required connectors and associated hardware are supplied with the connector kit..

CAUTION

Check wiring connections for errors before connecting any wiring harnesses. Incorrect wiring could cause internal component damage.

Table 1-7. Pin Contact and Crimp Tools Part Numbers

<table>
<tr><th>LRU</th><th>Contact Type</th><th>Garmin Contact Part Number</th><th>Recommended Positioner</th><th>Recommended Insertion/ Extraction Tool</th><th>Recommended Hand Crimping Tool</th></tr>
<tr><td>GDU 37X</td><td>Socket, Mil Crimp, Size 20</td><td>336-00094-00</td><td>M22520/2-08, Daniels K13-1</td><td rowspan="8">M81969/1-04 for size 22D pins and M81969/1-02 for size 20 pins</td><td rowspan="8">M22520/2-01</td></tr>
<tr><td>GSU 73</td><td rowspan="4">Pin, Mil Crimp, Size 22D</td><td rowspan="4">336-00021-00</td><td rowspan="4">Positronic P/N 9502-4, ITT P/N M22520/2-09, Daniels P/N K42</td></tr>
<tr><td>GTP 59</td></tr>
<tr><td>011-00979-20 (Config module w/EEPROM kit)</td></tr>
<tr><td>011-00981-00 (thermocouple kit)</td></tr>
<tr><td>GMU 44</td><td>Socket, Mil Crimp, Size 20</td><td>336-00022-00</td><td>M22520/2-08, Daniels K13-1</td></tr>
<tr><td>011-00979-22 (Config module w/Sockets & Jackscrew kit)</td><td>Socket, Mil Crimp, Size 20, 26-30 AWG</td><td>336-00022-01</td><td>Positronic P/N 9502-5</td></tr>
</table>

NOTES

1. Insertion/Extraction tools from ITT Cannon are all plastic; others are plastic with metal tip.
2. Non-Garmin part numbers shown are not maintained by Garmin and consequently are subject to change without notice.

1.7.2 Cable Location Considerations

Use cable meeting the applicable aviation regulation for the interconnect wiring. Any cable meeting specifications is acceptable for the installation. When routing cables, observe the following precautions:

- All cable routing should be kept as short and as direct as possible.
- Check that there is ample space for the cabling and mating connectors.
- Avoid sharp bends in cabling.
- Avoid routing near aircraft control cables.
- Avoid routing cables near power sources (e.g., 400 Hz generators, trim motors, etc.) or near power for fluorescent lighting.
- Route the GPS antenna cable as far as possible away from all COM transceivers and antenna cables.

1.7.3 Cable Installation

1. Route the coaxial cable to the unit location. Secure the cable in accordance with good aviation practices.

2. Trim the coaxial cable to the desired length and install the BNC connector (330-00087-00) per the cabling instructions on Figure 1-2. If the connector is provided by the installer, follow the connector manufacturer's instructions for cable preparation.

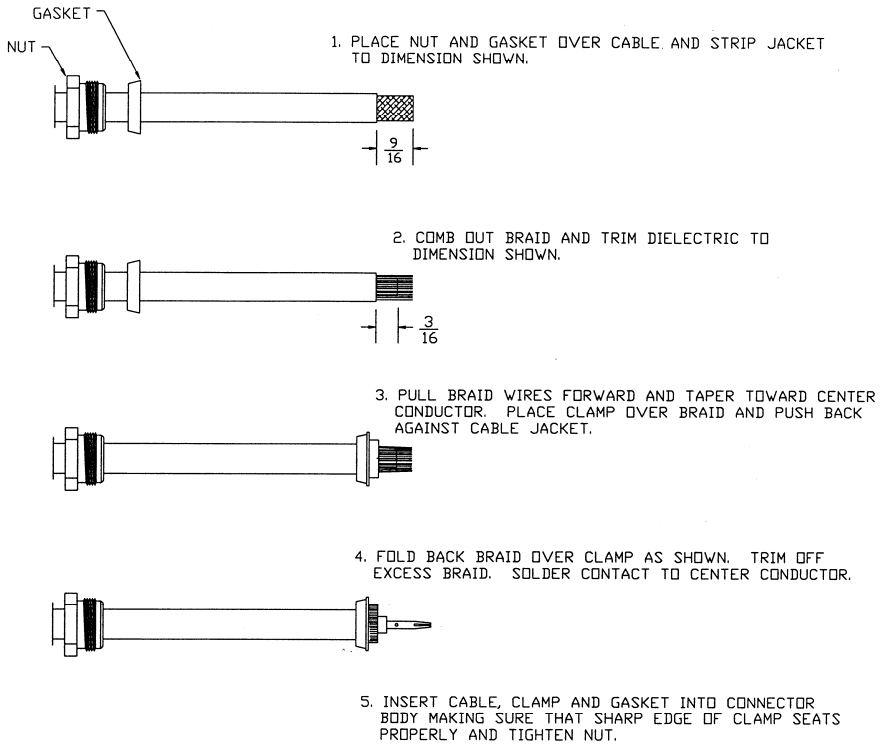


Figure 1-2. Coaxial Cable Installation

3. Contacts for the 50, 62, and 78 pin connectors must be crimped onto the individual wires of the aircraft wiring harness. Table 1-7 lists contact part numbers (for reference) and recommended crimp tools.

1.7.4 Backshell Assemblies

Connector kits include backshell assemblies. The backshell assembly houses the configuration module and a thermocouple reference junction (if applicable, see Appendix D). Garmin's backshell connectors give the installer the ability to quickly and easily terminate shield grounds at the backshell housing. The instructions needed to install the Jackscrew Backshell, Configuration Module, and Thermocouple are located in Appendix B.

NOTE

The GDU 37X rear connector (J3701) is electrically isolated. For installations using shielded cables, a ground pin must be tied to the connector shell.

2 GDU 37X

Figure 2-1. GDU 37X Unit View

2.1 Equipment Description

NOTE

There is no TSO/ETSO applicable to the GDU G37X.

The GDU 37X provides a central display and user interface for the G3X system. The display is mounted flush to the aircraft instrument panel using four #6 screws. The GDU 37X is available in two models, GDU 370 and GDU 375. The GDU 370 is a Garmin Display Unit with a VFR WAAS-GPS receiver. The GDU 375 provides these same features plus an XM receiver.

2.1.1 Navigation Functions

- Display of position and ground speed
- Display of stored navigation and map databases
- Area navigation functions using the determined position/velocity and stored navigation data
- Advisory approach navigation functions and associated databases

2.1.2 Interface Summary

The GDU 37X uses CAN and RS-232 communications interfaces. The GDU 37X communicates with the following Garmin LRUs:

- Other GDU 37X
- GSU 73
- SL30 Nav/Comm Transceiver
- SL40 Comm Transceiver
- GNS 400/500 Series Units
- GTX 327/330 Transponder

2.2 Electrical Specifications

2.2.1 Electrical Characteristics

Table 2-1. GDU 37X Supply Voltages

Characteristics	Specifications
Power Requirements	14/28 VDC

2.2.2 Power Consumption

Table 2-2. GDU 37X Power Requirements

LRU	14V (Maximum)	14V (Typical)	28V (Maximum)	28V (Typical)
GDU 370	15W, 1.10 Amp	8.5W, .600 Amp	15W, 0.540 Amp	8.5W, .300 Amp
GDU 375	15W, 1.10 Amp	9.5W, .675 Amp	15W, 0.540 Amp	9.25W, .330 Amp

2.2.3 GPS Specifications

The GDU 37X uses a high-sensitivity GPS receiver that continuously tracks and uses up to 12 satellites to compute and update its position.

Table 2-3. GDU 37X GPS Specifications

Characteristics	Specifications
Acquisition Time	a) Warm Start (position known to 10 nm, time known to 10 minutes, with valid almanac and ephemeris): Less than 5 seconds b) Cold Start (position known to 300 nm, time known to 10 minutes, with valid almanac): Less than 45 seconds c) AutoLocate™ (with almanac, without initial position or time): Less than 60 seconds
Update Rate	5/second, continuous
Positional Accuracy	<10 meters
Antenna Power Supply	Voltage (4.5 to 5.0), current (50 mA max)

2.2.4 Antennas

Table 2-4 lists Garmin and non-Garmin antennas currently supported by the GDU 37X. Refer to Section 6 for Garmin antenna installation information. For non-Garmin antennas, follow the manufacturer's installation instructions.

NOTE

Only a single GPS antenna is required for installations using more than one GDU 37X unit, as the GDU 37X will "share" the GPS information with all GDU 37X units.

Table 2-4. GDU 37X Supported Antennas

Model	Mount Style	Conn Type	Antenna Type	Mfr	Antenna Part Number	Garmin Order Number
Comant 2480-201 VHF/GPS [1]	Screw Mount, Teardrop Footprint	BNC TNC	VHF COM, GPS	Comant	CI 2480-201	N/A
Comant 420-10 XM only Antenna	Screw Mount, ARINC 743 Footprint	TNC	XM	Comant	CI 420-10	N/A
GA 26C	Suction Cup, Magnetic or Flange Mt	BNC	GPS	Garmin	011-00149-04	010-10052-04
GA 26XM	Ground Plane Mt	TNC	XM	Garmin	013-00268-10	010-11373-00
GA 55	Stud Mount	TNC	XM	Garmin	011-01033-00	010-10600-01
GA 55A	ARINC 743	TNC	XM	Garmin	011-01153-00	010-10598-00
GA 56	Stud Mount	BNC	GPS	Garmin	011-00134-00	010-10040-01
GA 57X [2]	Screw Mount, ARINC 743 Footprint	BNC TNC	GPS XM	Garmin	011-01032-10	010-11370-10

[1] The GPS antenna connector is TNC type. The VHF COM antenna connector is BNC type.

NOTE

The GPS antenna should provide a gain of 16 to 25dB, and requires a 4.5V to 5V supply voltage that can provide 50mA max.

2.3 Environmental Specifications

The GDU 37X has an Operating Temperature Range of -20°C to +60°C.

2.4 Installation Requirements

2.4.1 Accessories

The GDU 37X Connector Kit is provided with the GDU 37X unit and is required to install the unit (Figure 2-2). The GDU 37X Nutplate (115-01054-00) is also supplied with the unit to reinforce the panel cutout in thin panel installations.

The contents of the GDU 37X Connector Kit are listed in Table 2-5. One kit is required for each GDU 37X installed.

Table 2-5. Contents of GDU 37X Connector Kit (011-01921-00)**

Item	Garmin P/N	Quantity
Sub-Assy,bkshl w/Hdw,Jackscrew	011-01855-04	1
Conn, Rcpt,D-Sub, Crimp Socket, C	330-00625-50	1
Contact, Sckt, D-Sub, Crimp, Size 20	336-00094-00	20

2.4.2 Additional Equipment

A 3/32” hex drive tool is required to secure the GDU 37X to the panel as described in Section 2.7 Unit Installation.

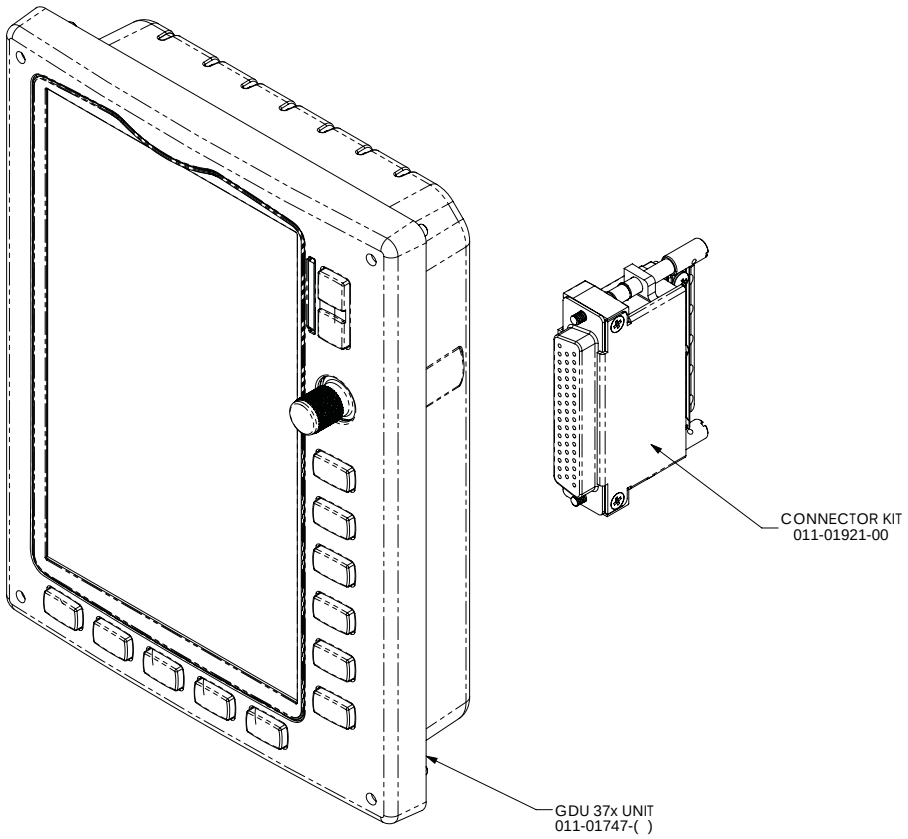


Figure 2-2. GDU 37X Mounting Accessories

2.5 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GDU 37X. Refer to Section 1.6 for wiring considerations and to Appendix A for pinouts.

Connector kits include backshell assemblies. Garmin's backshell connectors give the installer the ability to quickly and easily terminate shield grounds and install a configuration module (PFD1 only) at the backshell housing. The instructions needed to assemble the backshell connector w/Shield Block grounding system and configuration modules are located in Appendix B.

NOTE

The GDU 37X rear connector (J3701) is electrically isolated. For installations using shielded cables, a ground pin must be tied to the connector shell.

2.6 Mounting Requirements

Refer to Appendix C for outline and installation drawings.

2.7 Unit Installation

The GDU 37X is installed by holding the unit flush with the instrument panel and fastening the four captured 3/32" hex socket head screws to the panel as shown in Figures C-1.1 and C-1.2.

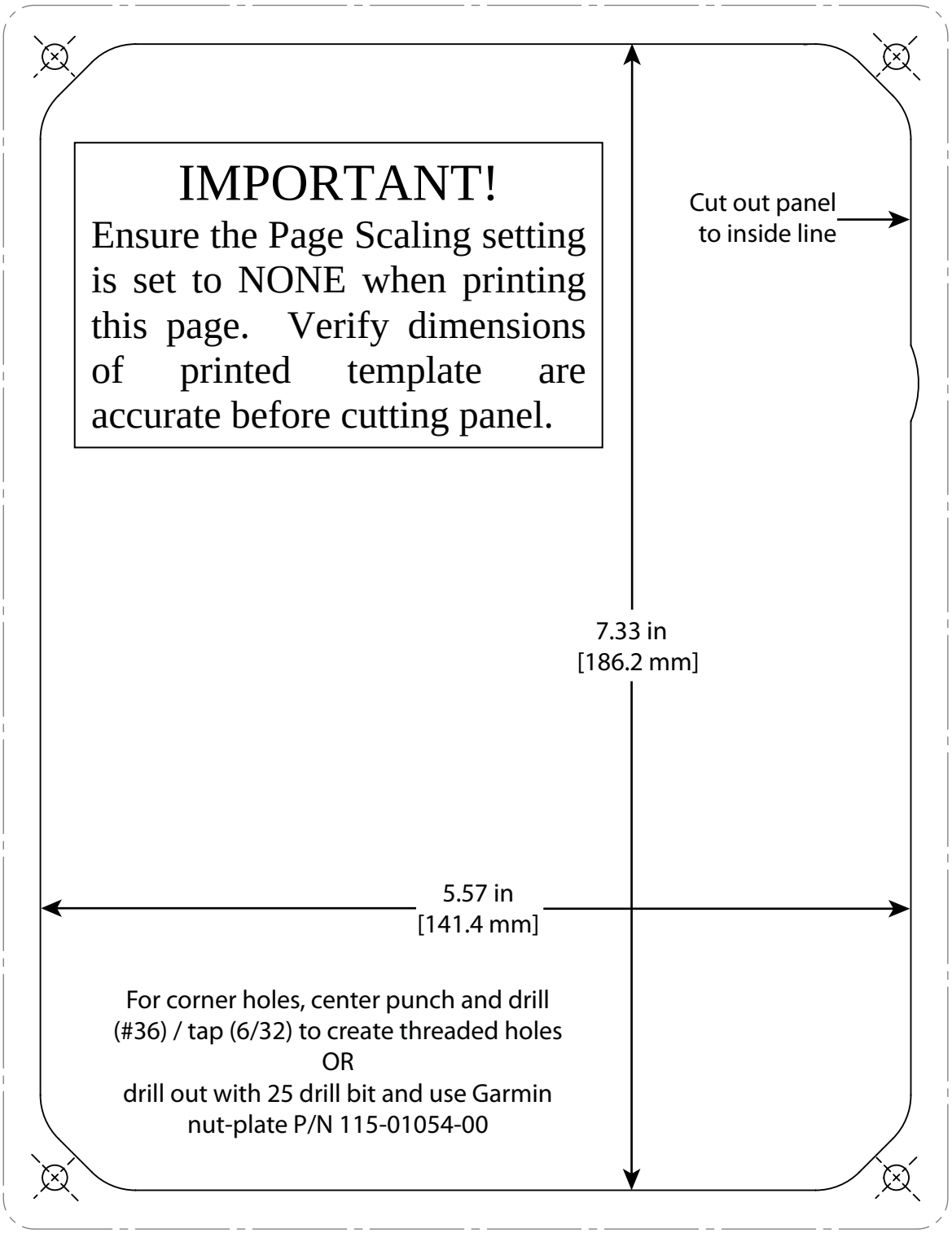
2.8 Maintenance

Maintenance of the GDU 37X is "on condition" only. Periodic maintenance of the GDU 37X is not required. Instructions for Continued Airworthiness (ICA) are not required for this product under 14 CFR Part 21 since the GDU 37X has received no FAA approval or endorsement.

2.9 Panel Cutout Template

The below drawing can be used as a template when marking the panel for cutout. Dimensions below are to verify accuracy of printout only, see Figure C-1.2 for complete dimensions.

GDU 37X PANEL CUTOUT TEMPLATE



3. GMU 44

Figure 3-1. GMU 44 Unit View

3.1 Equipment Description

The Garmin GMU 44 Magnetometer is a remote mounted device that interfaces with a Garmin GSU 73 to provide flight attitude and heading data for flight instrumentation.

An Attitude and Heading Reference System combines the functions of a Vertical Gyro and a Directional Gyro to provide measurement of Roll, Pitch and Heading angles. The Garmin ADAHRS and magnetometer replace traditional rotating mass instruments.

Using long-life solid-state sensing technology, the GMU 44 Magnetometer uses magnetic field measurements to create an electronically stabilized AHRS.

The GMU 44 magnetometer provides magnetic information to support the function of the GSU 73. The GSU 73 provides operating voltage to the GMU 44 Magnetometer.

3.1.1 Interface Summary

The following is an interface summary for the GMU 44.

- GMU 44 to GSU 73 Interface: Power, RS-232, RS-485 (19,200 baud)

3.2 Electrical Specifications

Table 3-1. GMU 44 Electrical Specifications

Specification	Characteristic
Power Requirements	Supply Voltage: 14/28 VDC. See Table 1-3 for current specifications.

3.3 Environmental Specifications

Table 3-2 lists general environmental specifications.

Table 3-2. GMU 44 Environmental Specifications

Specification	Characteristic
Regulatory Compliance	RTCA/DO-160D Environmental Conditions and EUROCAE/ED-14D
Unit Software	RTCA/DO-178B Level B
Operating Temperature Range	-55° C to +70° C
Altitude	55,000 Feet

3.4 GMU 44 TSO/ETSO Compliance

Table 3-3. TSO/ETSO Compliance

Function	TSO/ETSO/SAE/ RTCA/EUROCAE	Category	Applicable LRU SW Part Numbers	Applicable Custom Logic Device Part Numbers
Direction Instrument, Magnetic (Gyroscopically Stabilized)	TSO-C6d ETSO-C6d AS8013A		All 006-B0224-(__) except 006-B0224-Z(_)	All 006-C0048-0(_)

3.4.1 TSO/ETSO Deviations

The following table provides a list of applicable TSO and SAE deviations for the GMU 44.

Table 3-4. TSO/ETSO Deviations

TSO	Deviation
TSO-C6d (GMU 44)	1. Garmin was granted a deviation from TSO-C6d to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C6d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	3. Garmin was granted a deviation from TSO-C6d to use SAE AS 8013A instead of SAE AS 8013 as the Minimum Performance Standard.
	4. Garmin was granted a deviation from TSO-C6d to list this secondary TSO in the Installation Manual rather than on the article itself.
	5. Garmin was granted a deviation from TSO-C6d to list the DO-178B software level in the Installation Manual rather than on the article itself.
ETSO-C6d (GMU 44)	1. Garmin was granted a deviation from ETSO-C6d to use RTCA DO-160D instead of SAE AS 8013 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from ETSO-C6d to use SAE AS 8013A instead of SAE AS 8013 as the Minimum Performance Standard.

3.5 Installation Requirements

3.5.1 Equipment Available

Table 3-5. GMU 44 Part Numbers

Model	Catalog Part Number	Unit Part Number	Installation Rack
GMU 44	010-00296-10*	011-00870-10	No

*Included in G3X LRU Kit (K10-00016-00)

Table 3-6. GMU 44 Accessories

Item	Garmin P/N	Quantity
Sub Assy, Connector Kit, GMU 44	011-00871-00**	1
GMU 44 Universal Mount***	011-01779-01	1 (optional)
Installation Rack, GMU 44	115-00481-10**	1

**Included in G3X Installation Kit (K10-00017-00)
***Refer to AHRS Magnetometer Installation Considerations (190-01051-00) from www.garmin.com

3.6 Installation Considerations

NOTE

If the requirements listed in Table 3-7 cannot be met, a magnetometer interference test must be performed to ensure proper operation of the G3X system. Refer to the AHRS/Magnetometer Installation Considerations document (190-01051-00) available from the Garmin website (www.garmin.com).

The following guidelines describe proper mechanical installation of the Garmin GMU 44 Magnetometer. The guidelines include requirements for proper location selection in the aircraft, requirements for supporting structure and mechanical alignment and restriction on nearby equipment.

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GMU 44. Refer to Section 1.6 for wiring considerations and to Appendix A for pinouts.

The instructions needed to assemble the circular connector are located in Appendix B.

The GMU 44 is an extremely sensitive three-axis magnetic sensor. It is more sensitive to nearby magnetic disturbances than a flux gate magnetometer. For this reason, when choosing a mounting location for the GMU 44, observe the following distances from objects or devices that can disturb the magnetic field. Table 3-7 specifies required distances from magnetic disturbances for GMU 44 location.

Table 3-7. Required Distance from Magnetic Disturbances

Disturbance Source	Minimum Distance from GMU 44
Electric motors and relays, including servo motors	10 feet (3.0 meters)
Ferromagnetic structure greater than 1 kg total (iron, steel, or cobalt materials, especially landing gear structure)	8.2 feet (2.5 meters)
Ferromagnetic materials less than 1 kg total, such as control cables	3 feet (1.0 meter)
Any electrical device drawing more than 100 mA current	3 feet (1.0 meter)
Electrical conductors passing more than 100 mA current [(must be twisted shielded pair if within 10 feet (3.0 meters)]	3 feet (1.0 meter)
Electrical devices drawing less than 100 mA current	2 feet (0.6 meter)
Magnetic measuring device (e.g. installed flux gates, even if unpowered)	2 feet (0.6 meter)
Electrical conductors passing less than 100 mA current [(must be twisted shielded pair if within 10 feet (3.0 meters)]	1.3 feet (0.4 meter)

Ensure that any electrical conductor that comes within 10 feet (3.0 meters) of the GMU 44 is installed as a twisted shielded pair, not a single-wire conductor. (If possible, the shield should be grounded at both ends.)

Use nonmagnetic materials to mount the GMU 44, and replace any magnetic fasteners within 0.5 meter with nonmagnetic equivalents (e.g. replace zinc-plated steel screws used to mount wing covers or wingtips with nonmagnetic stainless steel screws).

In general, wing mounting of the GMU 44 magnetometer is strongly preferred. Fuselage mounting is strongly discouraged because of numerous potential disturbances that interfere with accurate operation.

Mechanical mounting fixtures for the GMU 44 must be rigidly connected to the aircraft structure. Use of typical aircraft-grade materials and methods for rigid mounting of components is acceptable, so long as adequate measures are taken to ensure a stiffened mounting structure.

Align the GMU 44 mounting rack to within 3.0° of the aircraft level reference in pitch and roll.

Align the GMU 44 mounting rack's forward direction to within 0.5° in heading of the aircraft forward direction (longitudinal axis). If it is not possible to guarantee this accuracy, installation alignment to within 2.5° in heading is acceptable in combination with a post-installation heading alignment of the aircraft to a precise heading to determine and set a heading offset. The heading offset procedure is described in Section 8.3.4.

It is strongly preferred that the GMU 44 alignment is within 0.5° of the aircraft longitudinal axis, rather than using the heading offset procedure.

3.6.1 Consideration for Wing Grounded Lighting Fixtures

The following installation practices are recommended if the required GMU 44 mounting bracket is located in the wing.

1. The wing tip lights should not have a power ground referenced to the chassis of the light assembly that would then be referenced back to the airframe ground via the light assembly mounting.
2. A dedicated power ground should be used and returned as a twisted pair with the power source back into the fuselage for a wing mounted GMU 44.

These installation practices will prevent magnetically interfering currents from flowing in the wing skin that encloses the GMU 44. Electrically isolating the light assembly should not be used as an alternative to item 1 above, unless the isolated light assembly has been analyzed for adequate protection against direct attachment of lightning.

Refer to Appendix C for outline and installation drawings.

3.7 GSU 73/GMU 44 Interconnect Harness Fabrication Instructions

Table 3-8 lists parts needed for the GMU 44 interconnect harness. Some of the parts for installation are included in the GMU 44 Connector Installation Kit. Other parts are provided by the installer. Reference numbers refer to item bubble numbers shown in Figure C-2.4.

Table 3-8. Parts Needed for GMU 44 Installation

Figure B-2.4 Ref	Description	Qty. Included	GPN or MIL Spec
1	Shield Termination (method optional)	0	Parts used depend on method chosen
2	Shield Extension Wire	0	M22759/16-22
3, 4, 9	GMU 44 Connector Kit**	1	011-00871-00
5	3-Conductor Cable	0	M27500-22TE3T14
6	2-Conductor Cable	0	M27500-22TE2T14

**Included in G3X Installation Kit (K10-00017-00)

Table 3-9 lists material in the GMU 44 connector kit and the associated reference number, as shown in Figure C-2.4. The GMU 44 magnetometer has an attached pigtail with male polarity. The harness connector for the GMU 44 has female polarity.

Table 3-9. GMU 44 Connector Kit (011-00871-00) Contents, Reference Figure C-2.4**

Item	Garmin P/N	Quantity	Figure C-2.4 Ref
Screw,6-32x.250,PHP,BR,w/Nyl	211-60037-08	3	9
Conn,Circular,Female,9 Ckt	330-00360-00	1	4
Backshell,Circular,Kit,SS	330-90005-01	1	4
Cont,Sckt,Mil Crp,Size 20	336-00022-00	10	3

**Included in G3X Installation Kit (K10-00017-00)

3.8 Mounting Instructions

After evaluation of the mounting location has been completed and ensuring that requirements are met, assemble the GMU 44 mounting plate kits according to the dimensions given in Appendix C. Install the unit assemblies.

Mount the GMU 44 to its mounting plate, taking care to tighten the mounting screws firmly. Use of non-magnetic tools (e.g. beryllium copper or titanium) is recommended when installing or servicing the GMU 44. Do **not** use a screwdriver that contains a magnet when installing or servicing the GMU 44.

The metal components in the GMU 44's connector may slightly affect the magnetic field sensed by the GMU 44. Place the connector at least 2 inches from the body of the GMU 44 to minimize this effect. After attaching the GMU 44's connector to its mate in the aircraft wiring, secure the connector in place using good installation practices. This will ensure that any remaining magnetic effect can be compensated for using Calibration Procedure C: Magnetometer Calibration (Section 9.3.3).

NOTE

If the GMU 44 is ever removed, the anti-rotation properties of the mounting screws must be restored. This may be done by replacing the screws with new Garmin PN 211-60037-08. If original screws must be re-used, coat screw threads with Loctite 242 (blue) thread-locking compound, Garmin PN 291-00023-02, or equivalent. Important: Mounting screws must be brass.

3.9 Maintenance

Maintenance of the GMU 44 is 'on condition' only. Periodic maintenance of the GMU 44 is not required.

4 GSU 73

4.1 Equipment Description

NOTE

There is no TSO/ETSO applicable to the GSU 73.

The GSU 73 is intended for the LSA (light sport aircraft) and experimental aircraft markets. The Garmin GSU 73 Sensor Unit is not a TSO-certified product and has received no FAA approval or endorsement. The GSU 73 is intended to be used as a part of the G3X system and it is not suitable for installation in type-certificated aircraft.

The GSU 73 is an LRU that provides AHRS and Air Data information as well as an interface to Engine/Airframe sensors in a single mechanical package. The GSU 73 interfaces to a remote mounted GMU 44 for heading information and also computes OAT and TAS from inputs provided by the GTP 59.

The GSU 73 is capable of maneuvers through a range of 360° in bank and pitch. The rotation rate capability is ±200° per second.

Bank error and pitch error are within ±1.25° over the range of 30° bank, left and right, and 15° pitch nose up and nose down. Heading is accurate to within 2° in straight and level flight.

Due to unsuitability of the magnetic fields near the Earth's poles, operational accuracy is unknown north of 70° North latitude and south of 70° South latitude. In addition, operational accuracy is unknown in the following two regions:

1) North of 65° North latitude between longitude 75° W and 120° W. (Northern Canada)
2) South of 55° South latitude between longitude 120° E and 165° E. (Region south of Australia and New Zealand)

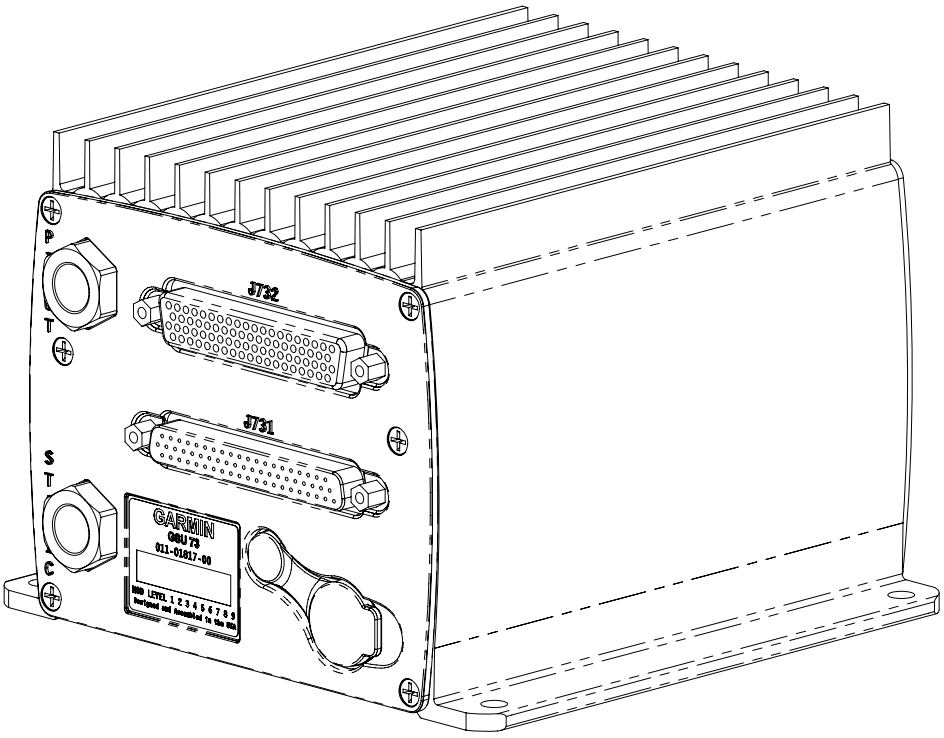


Figure 4-1. GSU 73 Unit View

4.1.1 Features Summary

Air Data

Pressure Altitude
Density Altitude
Vertical Speed
Mach Number
Indicated Airspeed
True Airspeed

Interfaces

CAN (1)
RS-232 (2 TX/2 RX)
ARINC 429 (4 RX/2 TX)
OAT Probe (GTP 59)
Magnetometer (GMU 44) (1 RS-232 TX/ 1 RS-485 RX)

AHRS

Magnetic Heading
Pitch Angle
Roll Angle
Linear Accelerations
Pitch, Roll, Yaw Rotation Rates

Engine/Airframe

28 Analog inputs, including those allocated as per below:
Dedicated Ammeters (2)
Constant Current Source Capability (6)
Divider Circuits to handle large input voltages (12)
Frequency Counter Inputs (4)
Discrete I/O (4 In/2 Out)

4.2 Electrical Specifications

Table 4-1. GSU 73 Supply Specifications

Characteristic	Specification
Input Voltage Range	10-29 Vdc*
Power Input	1.75 Amp @ 14 Vdc (Max) 0.80 Amp @ 28 Vdc (Max)

*Garmin recommends using a Mod 1level GSU 73 in aircraft that exclusively use a +28V supply.

4.3 Environmental Specifications

The GSU 73 is a non-TSO'd product, Table 4-2 lists general environmental specifications.

NOTE

The GSU 73 may require a warm-up period of 15 minutes to reach full accuracy (30 minutes if the environmental temperature is less than 0°C).

Table 4-2. GSU 73 Environmental Specifications

Characteristic	Specification
Aircraft Pressure Altitude Range	-1,400 feet to 50,000 Feet
Aircraft Vertical Speed Range	-20,000 feet per minute to +20,000 feet per minute
Aircraft Airspeed Range	450 Knots
Aircraft Mach Range	<1.00 Mach
Aircraft Total Air Temperature Range	-85°C to +85°C
Unit Operating Temperature Range	-40°C to +70°C
Max Outer Case Temperature	+73°C

4.4 Installation Requirements

4.4.1 Required Equipment

Table 4-3 lists the kits available for the GSU 73.

Table 4-3. GSU 73 Available Equipment

Item	Garmin P/N	Quantity
Configuration Module w/EEPROM and Jackscrew, Kit	011-00979-20**	1
Thermocouple Kit	011-00981-00**	1
Unit Assembly, GSU 73	011-01817-00*	1
P731 Connector Kit, GSU 73	011-01818-00**	1
P732 Connector Kit, GSU 73	011-01818-01**	1

*Included in G3X LRU Kit (K10-00016-00)
**Included in G3X Installation Kit (K10-00017-00)

Table 4-4. Contents of P731 Connector Kit (011-01818-00)**

Item	Garmin P/N	Quantity
Sub-Assy,Backshell w/Hdw,Jackscrew	011-01855-03	1
Connector ,Hi Dens, D-Sub, Mil Crimp 62ck	330-00185-62	1
Contact Pin, Mil Crimp, Size 22D	336-00021-00	20

**Included in G3X Installation Kit (K10-00017-00)

Table 4-5. Contents of P732 Connector Kit (011-01818-01)**

Item	Garmin P/N	Quantity
Sub-Assy,Backshell w/Hdw,Jackscrew	011-01855-04	1
Connector ,Hi Dens, D-Sub, Mil Crimp 78ck	330-00185-78	1
Contact Pin, Mil Crimp, Size 22D	336-00021-00	30

**Included in G3X Installation Kit (K10-00017-00)

4.4.2 Additional Equipment Required

- Cables: The installer will fabricate and supply all system cables.
- Hardware: #10-32 pan or hex head screw (4 ea.) and #10-32 self-locking nut (4 ea)
- Air hoses and fittings to connect pitot and static air to the GSU 73. The GSU 73 has a female 1/8-27 ANPT fitting for each pitot and static port. Use appropriate aircraft fittings to connect to pitot and static system lines.

4.5 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices should be used for installation of the GSU 73. Refer to Section 1.6 for wiring considerations, and to Appendix A for pinouts.

Connector kits include backshell assemblies. The backshell assembly houses the configuration module (P732 only) and a thermocouple reference junction (if applicable). Garmin's backshell connectors give the installer the ability to quickly and easily terminate shield grounds at the backshell housing. The instructions needed to install the Jackscrew Backshell, Configuration Module, and Thermocouple are located in Appendix B.

4.5.1 Pneumatic Plumbing

The GSU 73 has two ports that are connected to the aircraft's pitot pressure source and static pressure source. The two ports are labeled on the unit (see Figure 4-2). The pressure ports have 1/8-27 ANPT female threads. The mating fitting must have 1/8-27 ANPT male threads.

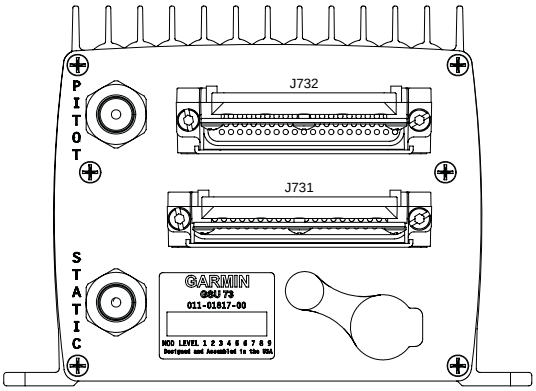


Figure 4-2. GSU 73 Air Hose Fitting Locations

Use appropriate air hoses and fittings to connect the pitot and static lines to the unit. Avoid sharp bends and routing near aircraft control cables. The GSU 73 should not be at the low point of the pitot or static plumbing lines, to avoid moisture or debris collecting at or near the unit. Ensure that no deformations of the airframe surface have been made that would affect the relationship between static air pressure and true ambient static air pressure for any flight condition. Refer to part 43, Appendix E for approved practices while installing hoses and connections.

4.5.2 Pneumatic Connections

The following steps should be used to aid in the fabrication of pneumatic hose connections and in attaching the aircraft pitot pressure source and aircraft static pressure source to the GSU 73.

CAUTION

Check pneumatic connections for errors before operating the GSU 73. Incorrect plumbing could cause internal component damage. Observe the following cautions when connecting pneumatic lines.

1. Make sure the aircraft static pressure port is plumbed directly to the unit static pressure input port and the aircraft pitot pressure port is plumbed directly to the unit pitot pressure input port.
2. Seal the threads of pneumatic fittings at the connector ports. Use caution to ensure there are no pneumatic leaks.
3. Use care to avoid getting fluids or particles anywhere within the pitot and static lines connected to the GSU 73.

The installer must fabricate any additional mounting equipment needed. Use outline and installation drawings in Appendix C for reference.

4.6 Mounting Requirements

Mount the GSU 73 with the connectors aligned within 1.0 deg of either the X or Y axis of the aircraft. The direction of the unit will be accounted for during the calibration procedure as shown in Figure 4-3.

Figure 4-3. GSU 73 Orientation Calibration

The GSU 73 includes an extremely sensitive strap-down inertial measurement unit. It must be mounted rigidly to the aircraft primary structure, preferably to a metallic structure to conduct heat away from the unit. Do not mount the GSU 73 in an enclosed area, it should be mounted in a location that provides adequate airflow to comply with the maximum outer case temperature listed in Section 4.3.

Do not use shock mounting to mount the GSU 73. Shock mounts used for other types of inertial systems are not acceptable for the GSU 73 AHRS. The mounting system must have no resonance with the unit installed. Excessive vibration may result in degraded accuracy.

The supporting plate must be rigidly connected to the aircraft primary structure through strong structural members capable of supporting substantial loads. Avoid areas that are prone to severe vibration.

The GSU 73 should be mounted within 13 feet (4.0 meters) longitudinally and 6.5 feet (2.0 meters) laterally of the aircraft center of gravity. In cases where the longitudinal distance from the CG is planned to be greater than 6.5 feet (2.0 meters), it is preferable to mount the GSU 73 forward of the aircraft center of gravity if possible, to enable better acceleration outputs for autopilot use. The mounting location for the GSU 73 should be protected from rapid thermal transients, in particular, large heat loads from nearby high-power equipment.

The GSU 73 must be leveled to within 3.0° of the aircraft level reference, and an aircraft leveling and offset calibration procedure carried out prior to flight. (This procedure is described in Section 9.) Alternatively, if the GSU 73 can be guaranteed level to within 0.25° of the aircraft level reference, the aircraft leveling and offset calibration procedure is not required.

Avoid placing the GSU 73 within 1 inch of magnetically mounted antennas, speaker magnets, or other strongly magnetic items.

4.7 Unit Installation

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

1. Assemble the wiring harness and backshell connectors.
2. Assemble the pneumatic hoses and connectors.
3. Mount the unit to a suitable mounting location using #10-32 pan or hex head screws (4 ea) per the requirements in Section 4.6.
4. Connect backshell connector and hoses.

NOTE

When mounting the GSU 73 to the airframe, it is important to ensure that fastening hardware is tight for proper unit operation.

4.8 Maintenance

Per Part 43 Appendix E, paragraph (b)(2), Garmin specifies a test procedure equivalent to part 43 Appendix E, paragraph (b)(1) with two exceptions. The tests of sub-paragraph (iv)(Friction) and (vi) (Barometric Scale Error) are not applicable because the digital outputs of the GSU 73 are not susceptible to these types of errors.

A GSU 73 Field Calibration Tool (not yet available) can be used to adjust the calibration of GSU 73 units that have failed the 14 CFR Part 43 Appendix E tests due to altitude drift.

The GSU 73 utilizes an Earth magnetic field model which is updated once every five years. This IGRF (International Geomagnetic Reference Field) update is expected to be available from Garmin by July 1 of each of the following years: 2010, 2015, and every five years thereafter, so long as the GSU 73 remains a Garmin –supported product. The IGRF model can be updated by the end user via the internet, it is not necessary to return the GSU 73 to Garmin for this update. Otherwise maintenance of the GSU 73 is 'on condition' only.

5 GTP 59

Figure 5-1. GTP 59

5.1 Equipment Description

The Garmin GTP 59 is an outside mounted temperature probe that provides raw air temperature data. The temperature input device is a three-wire temperature probe interface. OAT Power Out and OAT High are connected internally at the OAT probe. The GTP 59 is a Resistive Temperature Device (RTD).

5.1.1 Available Equipment

The GTP 59 is available per the following part number.

Table 5-1. GTP 59 Part Number

Item	Garmin Part Number
GTP 59 OAT Probe Kit	011-00978-00*

*Included in G3X LRU (K10-00016-00)

5.2 Installation Requirements

Table 5-2 contains a list of items found in the GTP 59 Outside Air Temperature (OAT) Probe kit (011-00978-00). The GTP 59 probe has an attached pigtail.

Table 5-2. GTP 59 Outside Air Temperature Kit*

Item	Garmin P/N	Quantity
Nut, 5/16”, Hex, Skirt	210-00055-00	1
Screw, 4-40 x .250, PHP, SS/P, w/NYL	211-60234-08	2
Washer, Lock, Self-Sealing, 5/16	212-00026-00	1
Contact, Pin, Mil Crimp, Size 22D	336-00021-00	5
GTP 59 OAT Probe	494-00022-xx	1

*Included in G3X LRU Kit (K10-00016-00)

5.2.1 Additional Equipment Required

- Cables - The installer will supply all system cables.

5.3 TSO/ETSO Compliance

The following table provides a list of applicable TSO/ETSOs for the GTP 59.

Table 5-3. Applicable TSO/ETSOs for the GTP 59

Function	TSO/ETSO	Applicable LRU SW Part Numbers	Applicable CLD Part Numbers
Air Data Computer	TSO-C106 ETSO-C106	Not Applicable	Not Applicable

5.3.1 TSO/ETSO Deviations

The following deviations have been requested and granted for the GTP 59.

Table 5-4. TSO/ETSO Deviations for the GTP 59

TSO/ETSO	Deviation
TSO-C106	1. Garmin was granted a deviation from TSO-C106 to use RTCA DO-160D, including changes 1, 2, and 3, instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C106 to use Society of Automotive Engineers (SAE) AS 8002 Rev A instead of SAE AS 8002 as the Minimum Performance Standard.
ETSO-C106	1. Garmin was granted a deviation from ETSO-C106 to use Society of Automotive Engineers (SAE) AS 8002 Rev A instead of SAE AS 8002 as the Minimum Performance Standard.

5.4 Installation Considerations

5.4.1 GTP 59 Icing

The GTP 59 OAT probe has no icing protection. If ice accumulates on the GTP 59 OAT probe, its accuracy is unknown. Consequently, air temperature measurements may be incorrect if ice accumulates on the probe. Furthermore, computations dependent upon air temperature measurements may be affected (e.g. true airspeed and delta-ISA).

5.4.2 GTP 59 OAT Probe Installation

NOTE

The following instructions are general guidance.

NOTE

Do not mount the GTP 59 where aircraft exhaust gases will flow over it.

Table 5-5 contains a list of parts needed for the GTP 59 installation and interconnect harness. Reference numbers in the table and instructions refer to item bubble numbers shown in Figure C-4.1.

Table 5-5. Parts Needed for GTP 59 Installation

Figure C-4.1	Description	Qty. Included	GPN
1	Ring Terminal	1	494-00022-xx
2	3-Conductor Cable		
3	OAT Sensor		
4	Nut	1	210-00055-00
5	Washer	1	212-00026-00

1. Prepare the surface. The metal body of the OAT probe should be grounded to the aircraft. The installation requirements vary depending on the airframe material composition.

   a. Aluminum airframe: When a mounting location has been found, prepare the inside surface of the aircraft. Remove all paint from the contacting area and clean with a degreaser.

   b. Composite airframe: If possible, mount the OAT probe through a grounded metal strap or band. Otherwise, mount the OAT probe in an area of the airframe that has a significant amount of underlying metal foil or mesh. To ensure adequate conductivity, it may be necessary to mount the OAT probe through a metal doubler. Use fasteners that allow a conductive path to the airframe.

2. Mount the OAT probe on the prepared surface. Place the ring terminal (2) over the end of the OAT probe (4). Insert the probe and ring terminal into the hole in the skin of the aircraft. Place the washer (6) over the end of the OAT probe on the outside skin of the aircraft. Thread the nut (5) onto the OAT probe. Holding the OAT probe on the inside, tighten the nut (5) to 100 inch-lbs. ±20 inch-lbs.

3. Route the OAT probe cable (3) to the GSU 73.

4. Cut the OAT Probe cable (3) to the required length. Strip back 2.0” to 3.5” of jacket while retaining the shield on the OAT Probe cable (3). Trim away enough to leave 0.5” of shield exposed.

5. Strip back 1/8” (0.125”) of insulation and crimp pins (11) to each of the conductors in the shielded cable.
6. Cut an AWG #16 (8) wire to 3” long. Strip back 0.5” of insulation from this cable. Connect the shield of the OAT Probe cable (3) to the AWG #16 wire (8).

7. Attach the ring terminal (9) to the backshell, using the screw provided in the OAT Probe Kit (10) and one of the tapped holes on the backshell termination area.

8. Insert newly crimped pins into the D-Sub connector and wires (3, 11) into the appropriate connector housing location (12, 7) as specified by the installation wiring diagrams.

9. Verify that all necessary pins for the GSU 73 have been attached to the cables and snapped into the proper slots of the 78 pin D-Sub connector.

10. Wrap the cable bundle with Silicone Fusion Tape (GPN: 249-00114-00 or a similar) at the point where the backshell strain relief and cast housing contact the cable bundle. The smooth side of the backshell strain relief should contact the tape.

5.5 Unit Installation

Refer to Figure C-4.1 GTP 59 O.A.T. Probe Wiring Detail for wiring and mounting instructions.

5.6 Maintenance

Maintenance of the GTP 59 is “on condition” only. Periodic maintenance of the GTP 59 is not required.

6 Garmin GPS/XM Antennas

For non-Garmin antennas, follow the manufacturer's installation instructions. If using a Garmin GA 26C or GA 26XM, refer to the accompanying installation instructions (190-00082-00 or 190-00522-03). For GA 55/55A, or GA 56 or GA 57X antennas, refer to this section and the drawings in Appendix C.

Garmin recommends the antennas shown in Tables 6-1 and 6-3. However, any equivalent GPS or XM antenna that meets the specifications listed in Tables 6-2 and 6-4 should work with the G3X.

6.1 GPS Antennas

Table 6-1. GPS Antennas

Model	Part Number	Description	Weight	Mounting Configuration
GA 26C	011-00149-04	GPS Antenna	NA	Flange, Magnetic, or Suction Cup Mount (for in-cabin mounting)
GA 56	011-00134-00	GPS Antenna	0.24 lbs (0.11 kg)	Stud mount (Tear-drop form factor)
GA 57X	011-01032-10	GPS/XM Antenna	0.47 lbs (0.21 kg)	Thru-mount (ARINC 743 style mount)

Table 6-2. GPS Antenna Minimum Requirements

Characteristics	Specifications
Frequency Range	1565 to 1585 MHz
Gain	16 to 25 dB typical, 40dB max.
Noise Figure	<4.00 dB
Nominal Output Impedance	50 ohms
Supply Voltage	4.5 to 5.5 VDC
Supply Current	up to 50 mA
Output Connector	BNC

6.2 XM Antennas

Table 6-3. XM Antennas

Model	Part Number	Description	Weight	Mounting Configuration
GA 26XM	013-00268-10	XM Antenna	NA	Flange, Magnetic, or Suction Cup Mount (for in-cabin mounting)
GA 55	011-01033-00	XM Antenna	0.25 lbs (0.11 kg)	Stud mount (Tear-drop form factor)
GA 55A	011-01153-00	XM Antenna	0.43 lbs (0.20 kg)	Thru-mount (ARINC 743 style mount)
GA 57X	011-01032-10	GPS/XM Antenna	0.47 lbs (0.21 kg)	Thru-mount (ARINC 743 style mount)

Table 6-4. XM Satellite Radio Antenna Minimum Requirements

Characteristics	Specifications
Frequency Range	2332.5 to 2345 MHz
Gain (Typical)	24 dB*
Noise Figure	<1.2 dB
Nominal Output Impedance	50 ohms
Supply Voltage	3.6 to 5.5 VDC
Supply Current (maximum)	55 mA
Operating Temperature Gain	-50 to +85°C

*For each 1 dB gain over 24 dB, add 1 dB of attenuation into the antenna cable path between the antenna and the GDU 375.

It is the installer's responsibility to ensure that their choice of antenna meets FAA standards according to the specific installation. This installation manual discusses only the antennas listed in Tables 6-1 and 6-3. Other antennas may be acceptable but their installation is not covered by this manual.

There are several critical factors to take into consideration before installing an antenna for a satellite communications system. These factors are addressed in the following sections.

6.3 Antenna Mounting Considerations

The information in this section does not pertain to in-cabin (internal) mounted antennas such as the GA 26C, refer to the accompanying installation instructions (190-00082-00).

No special precautions need be taken to provide a bonding path between the GPS Antenna and the aircraft structure.

6.3.1 VHF COM/GPS Interference

On some installation VHF COM transceivers, Emergency Locator Transmitter (ELT) antennas, and Direction Finder (DF) receiver antennas can re-radiate through the GPS antenna. The GDU 37X does not interfere with its own GPS receiver. However, placement of the GPS antenna relative to a COM transceiver and COM antenna, ELT antenna, and DF receiver antenna is critical.

Use the following guidelines, in addition to others in this document, when locating the GDU 37X and its antennas.

- GPS Antenna—Locate as far as possible from all COM antennas and all COM transceivers, ELT antennas, and DF antennas. The GPS antenna is less susceptible to harmonic interference if a 1.57542 GHz notch filter is installed on the COM transceiver antenna output.
- Locate the GDU 37X as far as possible from all COM antennas.

If a COM antenna is found to be the problem, a 1.57542 GHz notch filter (Garmin P/N 330-00067-00) may be installed in the VHF COM coax, as close to the COM as possible.

If a COM is found to be radiating, the following can be done:

1. Replace or clean the VHF COM rack connector to ensure good coax ground.
2. Place grounding straps between the GDU 37X unit, VHF COM and a good ground.
3. Shield the VHF COM wiring harness.

6.3.2 GPS/XM Antenna Mounting Location

The GPS antenna is a key element in the overall system performance and integrity for a GPS navigation system. The mounting location, geometry, and surroundings of the antenna can affect the system performance and/or availability. The following guidance provides information to aid the installer in ensuring that the optimum location is selected for the installation of the GPS antenna. The installation guidelines presented here meet the intent of AC 20-138A section 16. The greater the variance from these guidelines, the greater the chance of decreased availability. Because meeting all of these installations guidelines may not be possible on all aircraft, these guidelines are listed in order of importance to achieve optimum performance. Items 1-4 below are of equal importance and their significance may depend on the aircraft installation. The installer should use their best judgment to balance the installation guidelines.

1. Mount the antenna on top of the aircraft in a location with an unobstructed view of the sky, as close to level as possible with respect to the normal cruise flight attitude of the aircraft. If the normal flight attitude is not known, substitute the waterline, which is typically referenced as level while performing a weight and balance check.
2. The GPS antenna should be mounted in a location to minimize the effects of airframe shadowing during typical maneuvers. Typically mounting farther away from the tail section reduces signal blockage seen by the GPS antenna.
3. The GPS antenna should ideally be located at the opposite end of the aircraft from the COM unit in order to make the GPS less vulnerable to harmonics radiated from the COM itself (see Section 1.7.3 for more GPS/COM interference information).

4a. The GPS antenna should be mounted no closer than two feet (edge to edge) and ideally three feet from any VHF COM antenna or any other antenna which may emit harmonic (or other) interference at the L1 frequency of 1575.42 MHz. An aircraft EMC check (reference VHF COM interference check in Post Installation Checkout procedures) can verify the degradation of GPS in the presence of interference signals. If an EMC check reveals unacceptable interference, insert a GPS notch filter in line with the offending VHF COM or the (re-radiating) ELT transmitter.

NOTE

The separation requirement does not apply to GPS and COM combination antennas, provided the antenna has been tested to meet Garmin's minimum performance standards. The separating requirement includes the combination with an XM antenna element as well.

4b. The GPS antenna should be mounted no closer than two feet (edge to edge) and ideally three feet from any antennas emitting more than 25 watts of power. An aircraft EMC check can verify the degradation of GPS in the presence of interference signals.

4c. To minimize the effects of shadowing at 5° elevation angles, the GPS antenna should be mounted no closer than 6 inches (edge to edge) from other antennas, including passive antennas such as another GPS antenna or XM antenna.

5. To maintain a constant gain pattern and limit degradation by the windscreen, avoid mounting the antenna closer than 3 inches from the windscreen.
6. For multiple GPS installations, the antennas should not be mounted in a straight line from the front to the rear of the fuselage. Also varying the mounting location will help minimize any aircraft shading by the wings or tail section (in a particular azimuth, when one antenna is blocked the other antenna may have a clear view).

Figure 6-1 shows the recommended placement of antennas.

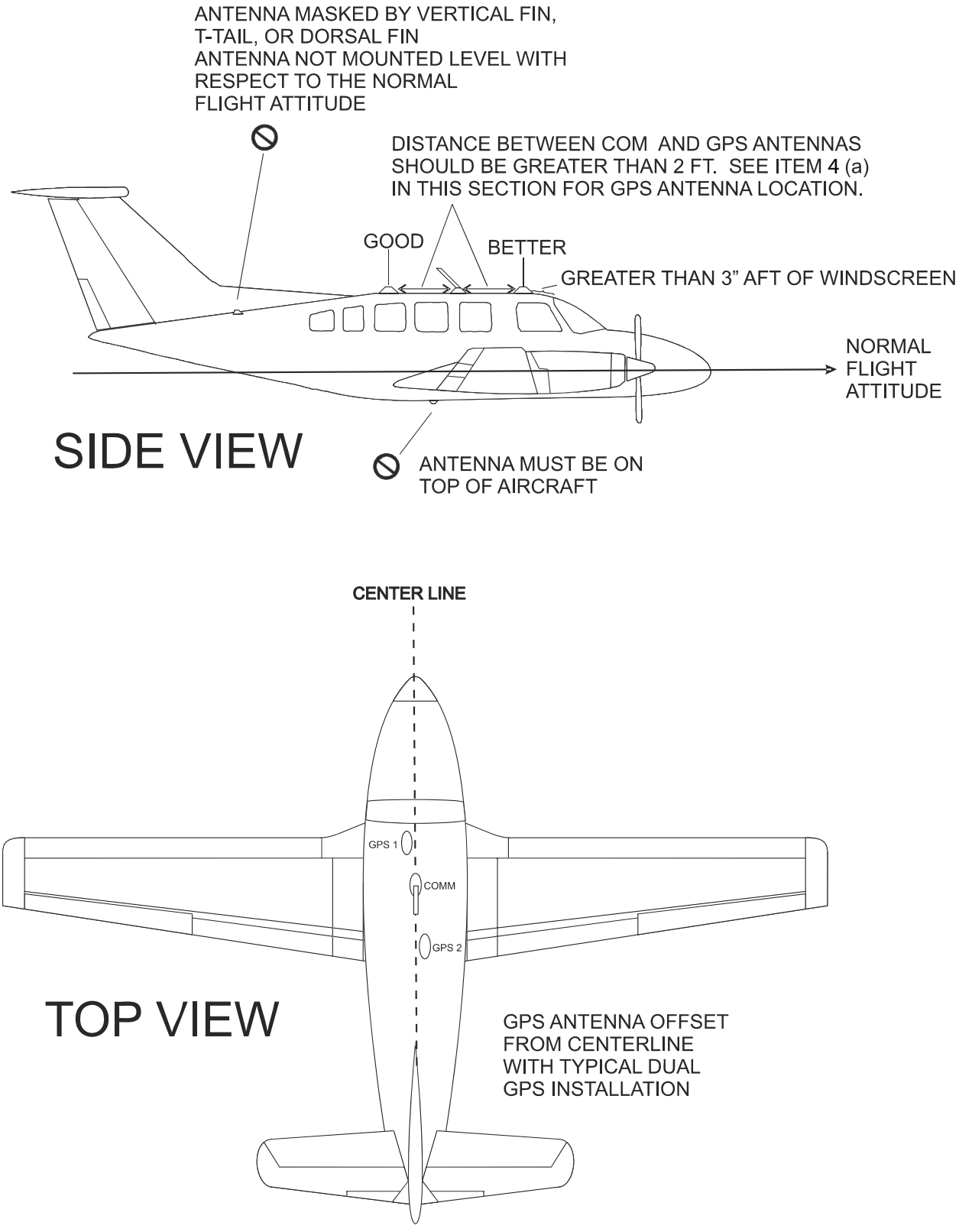


Figure 6-1. Recommended Antenna Placement

6.3.3 Buried Antenna (below the skin covering or glareshield) Mounting

There are potential performance issues related to buried antennas that the kit builder/installer should be aware of prior to electing to install a buried antenna. See also Section 6.6.3, Non-structural Installation to Glareshield.

- Some gain of the antenna may be lost as the signal needs to penetrate through the skin of the aircraft. The loss may not be apparent, but under the some of the worst case signal scenarios signal availability may be affected.
- The materials in some aircraft are not suitable for GPS signals to penetrate, care should be taken to properly modify the aircraft structure to accommodate this. Modifications of this sort are not recommended or inferred by Garmin or the installation of the G3X, and the installer should seek the guidance of the kit manufacture for such modifications.
- XM – FIS antennas may typically be buried without performance impact if the overlying material is fairly transparent to the satellite signal.

Figure 6-2 shows example areas of some mounting locations which have been used. Low satellite reception and tracking are compromised in these installations due to fuselage and tail blockage. It is not possible to determine the full impact of these locations, however initial flight testing has not shown any significant impact to GPS signal availability, your results may vary.

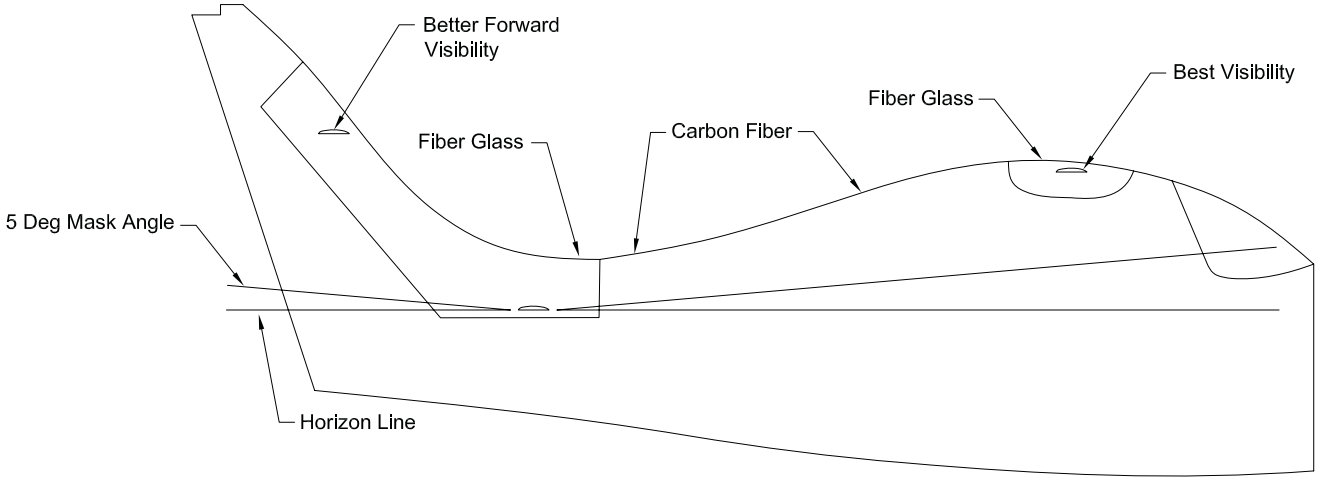


Figure 6-2. Carbon/Glass Buried Antenna Area

Mounting the antenna under the glare shield (Figure 6-3) is a good option for XM – FIS antennas, although it is not typically the best option for a GPS antenna. This location results in the aft fuselage shading the antenna.

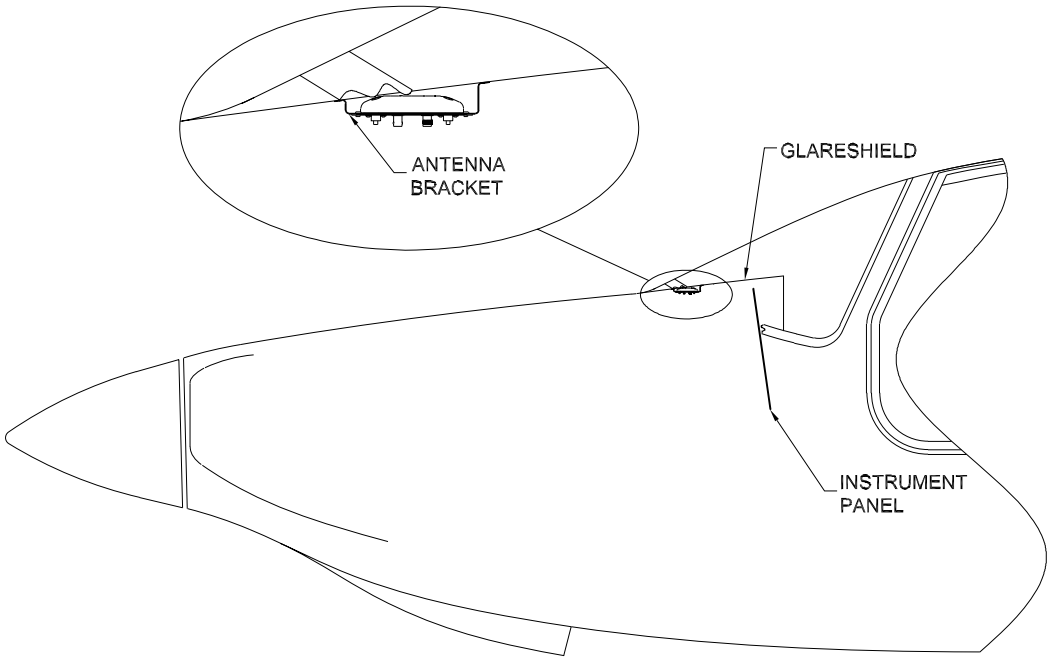


Figure 6-3. Glare Shield Buried Antenna Area

NOTE

Due to the excessive temperature environment and large areas of signal blockage caused by the fuselage, mounting the antenna under the engine cowling (forward of the firewall) is not recommended and likely will **not** provide adequate GPS reception.

6.3.4 Antenna Doubler/Backing Plate

The antenna installation must provide adequate support for the antenna considering a maximum drag load of 5 lbs. (at subsonic speed). When penetrating the skin with a large hole (i.e. for the coax connector) a doubler plate is required to re-instate the integrity of the aircraft skin. Never weaken the aircraft structure when choosing a mounting area. Make use of any available reinforcements where appropriate.

6.3.5 Antenna Grounding Plane

Although no ground plane is required, the antennas typically perform better when a ground plane is used. The ground plane should be a conductive surface as large as practical, with a minimum diameter of 8 inches. To use an antenna in aircraft with fabric or composite skin, a ground plane is recommended. It is usually installed under the skin of the aircraft, below the antenna, and is made of either aluminum sheet or of wire mesh.

6.3.6 Antenna Grounding

The antenna is grounded through the mounting hardware and the coax connection. The mounting hardware (washers and nuts) and doubler plate should make contact with an unpainted grounded surface ensuring proper antenna grounding. It is important to have good conductivity between the coaxial shield and the ground plane. The bottom of the antenna does not need to make contact with the ground plane (i.e. the surface may be painted). The antenna will capacitively couple to the ground plane beneath the paint or aircraft cover.

6.4 Teardrop Footprint Antenna Installation (GA 55 and GA 56)

This section describes the structural mounting of the teardrop footprint antenna installation.

An acceptable installation method is to use Garmin P/N: 115-00846-10 doubler plate with the GA 55 or GA 56 stud mount antennas. Another acceptable method is to fabricate and install one of three doublers (Figure 6-4, Figure 6-5, and Figure 6-6), depending on the thickness of the skin. The three doubler designs vary only by number of rivets and hole preparation for installation with flush rivets. Table 6-5 provides a summary of design and installation details for selecting the appropriate antenna doubler/backplate.

Figure 6-7 shows an example of the doubler installed between stringers on the top fuselage skin, just off centerline. The location should be flat, with no gaps between the skin and doubler, to keep from deforming the skin during installation.

Table 6-5. Teardrop Footprint Antenna Doubler Design and Installation

Aircraft Skin Thickness	**0.032" to 0.049"**	**0.049" to 0.051"**	**0.051" to 0.063"**
Doubler Design (Figure)	Figure 6-4	Figure 6-5	Figure 6-6
Number of Rivets Required	12	16	16
Type of Rivets Required[1]	MS20426AD4-x	MS20426AD4-x	MS20426AD4-x
Skin Preparation for Rivets	Dimple	Dimple	Countersink
Doubler Preparation for Rivets	Countersink	Countersink	None
Skin Cutout Detail (Figure)	Figure 6-8	Figure 6-9	Figure 6-10
Doubler Installation (Figure)	Figure 6-11	Figure 6-12	Figure 6-13

Notes:

1. Rivet length determined at installation, dependent on thickness of material (rivet length = grip length + 1.5*rivet diameter)

Refer to Figure B-2.X for Garmin Antenna installation drawings.

6.4.1 Preparation of Doubler

1. Use Garmin P/N: 115-00846-10, or refer to Table 6-5 for guidance on selecting the appropriate doubler drawing based on the thickness of skin at the antenna location. Make the doubler from 2024-T3 Aluminum (AMS-QQ-A-250/5), 0.063" sheet thickness.

2. For installation in aircraft skins of thickness less than 0.051", countersink the rivet holes in the doubler for use with flush head rivets (MS20426AD4-x).

3. When using Garmin P/N: 115-00846-10 doubler, sixteen rivet holes exist in the part. For installation of Garmin P/N: 115-00846-10 in skins of thickness between 0.032" and 0.049", only the rivets identified for use through the skin cutout detail (Figure 6-8) and doubler installation (Figure 6-11) are required.

6.4.2 Antenna Installation Instructions

1. Refer to Table 6-5 and the drawings in Appendix C for guidance on selecting the appropriate mounting cutout. Drill or punch the holes to match the mating part (doubler).

2. Install a doubler plate to reinforce the aircraft skin, as required. Refer to Section 6.4.1 for doubler preparation and Table 6-5 for additional guidance on the doubler installation. Dimple aircraft skin when the skin thickness is less than 0.051" for installation of flush head rivets. Countersink aircraft skin when the skin thickness is between 0.051" and 0.063" for installation of flush head rivets.

3. For the stud mount teardrop footprint antenna, place install gasket on top of aircraft skin using the four screw holes to align the gasket.

4. Washers and locking nuts are required to secure the antenna. Torque the four #8-32 stainless steel locking nuts 12-15 in-lbs. Torque should be applied evenly across all mounting studs or screws to avoid deformation of the mounting area.

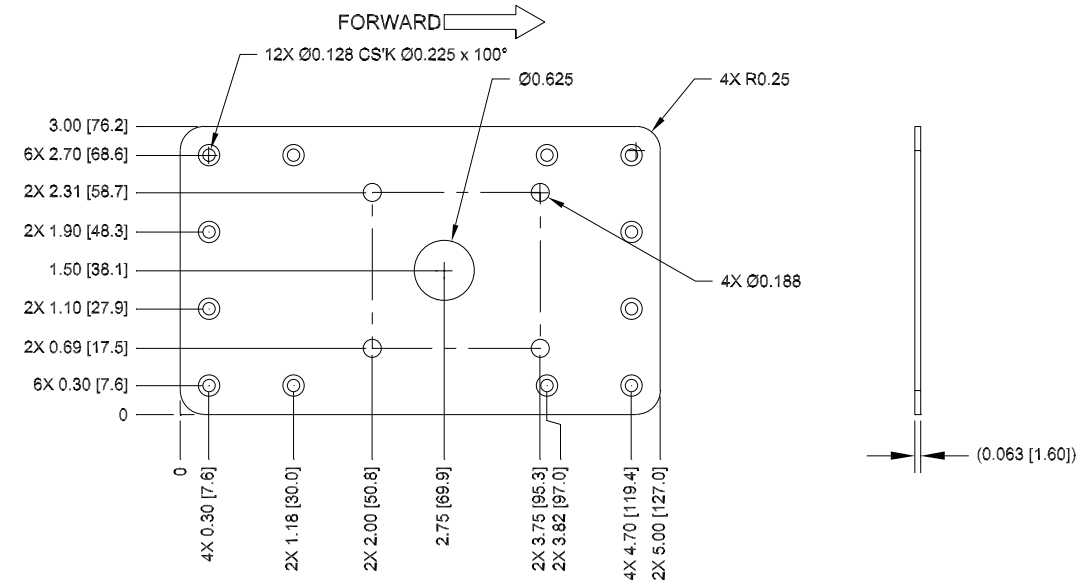
5. Ensure that the antenna base and aircraft skin are in continuous contact with the gasket or o-ring, as appropriate to the antenna model.

6. Seal the antenna and gasket to the fuselage using Dow Corning 738 Electrical Sealant or equivalent. Run a bead of the sealant along the edge of the antenna where it meets the exterior aircraft skin. Use caution to ensure that the antenna connectors are not contaminated with sealant.

CAUTION

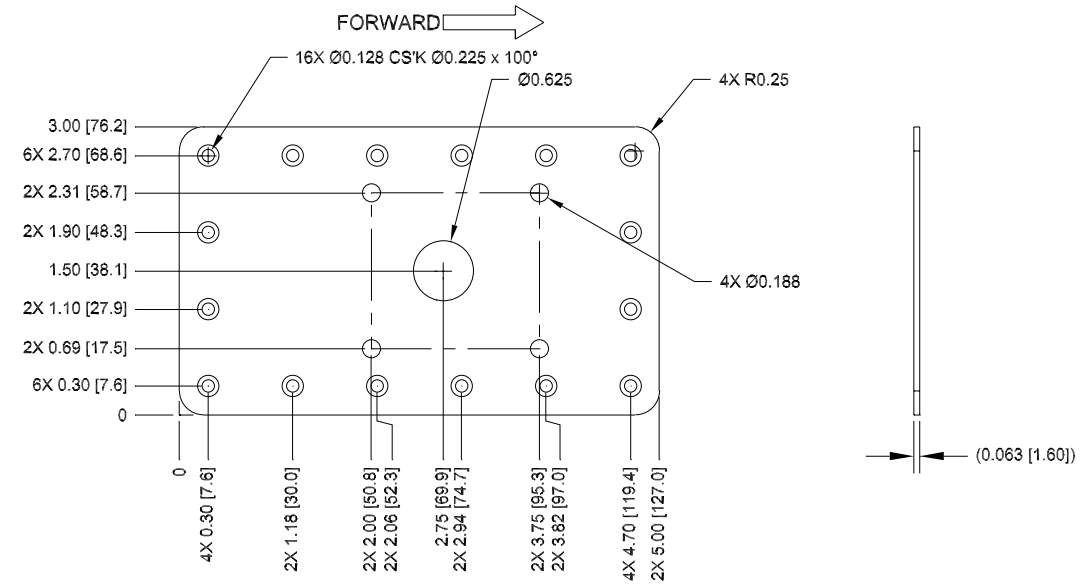
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

6.4.3 Reference Figures



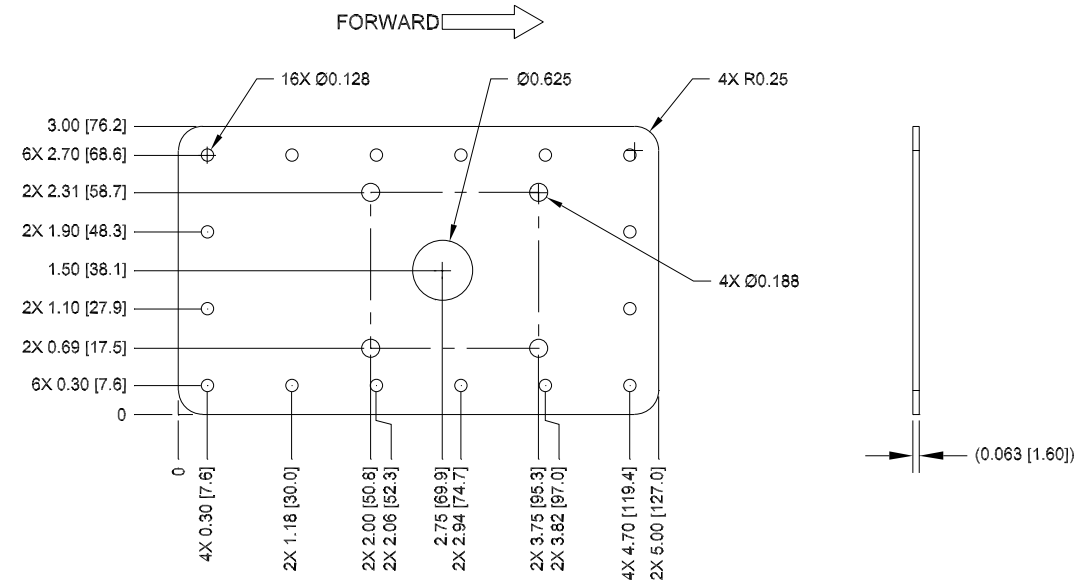
NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 6-4. Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 6-5. Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 6-6. Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

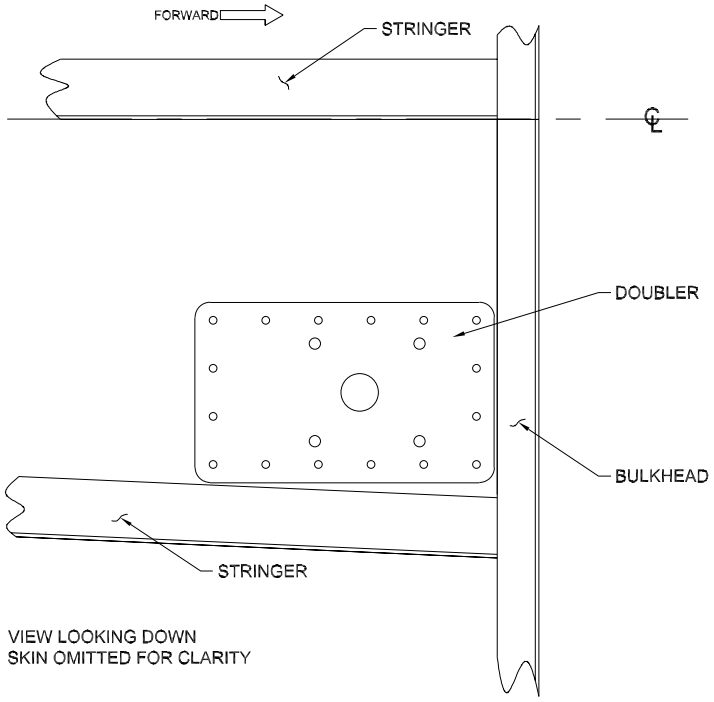
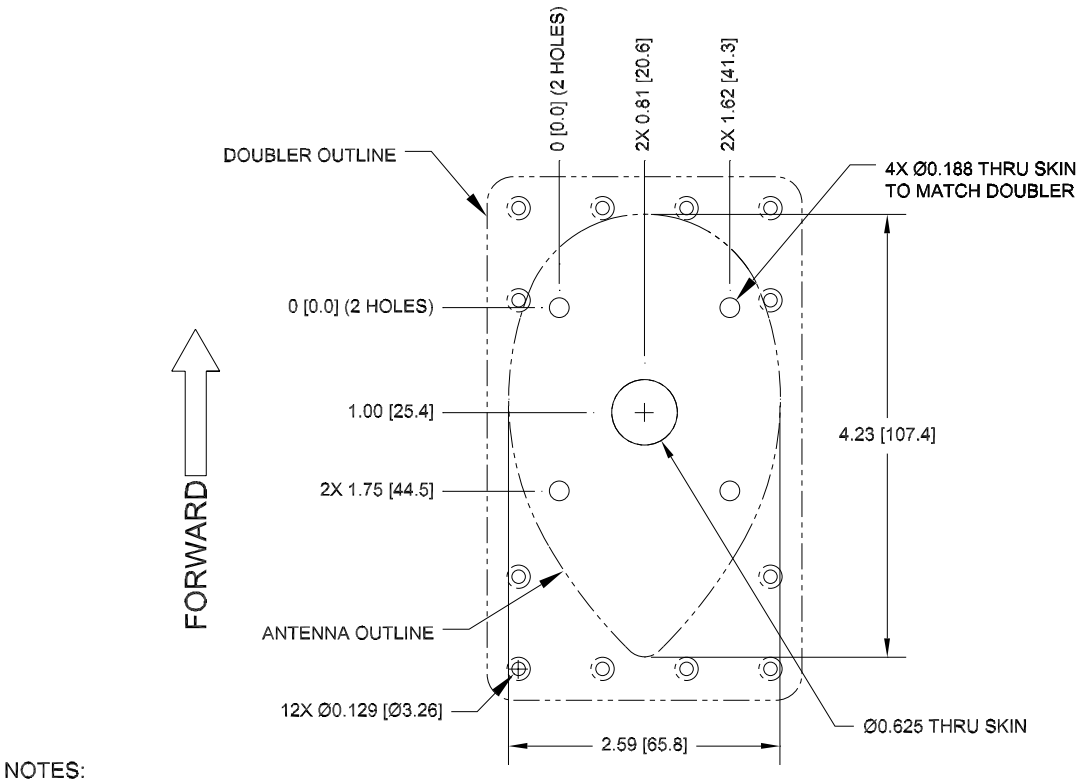
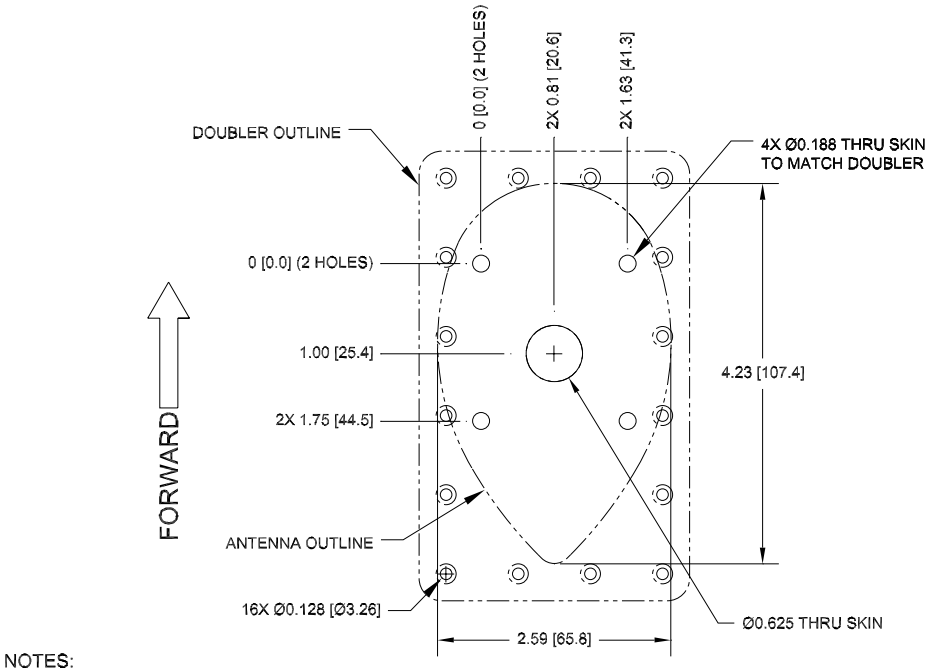


Figure 6-7. Sample Doubler Location, Teardrop Footprint Antenna, Metal Skin Aircraft



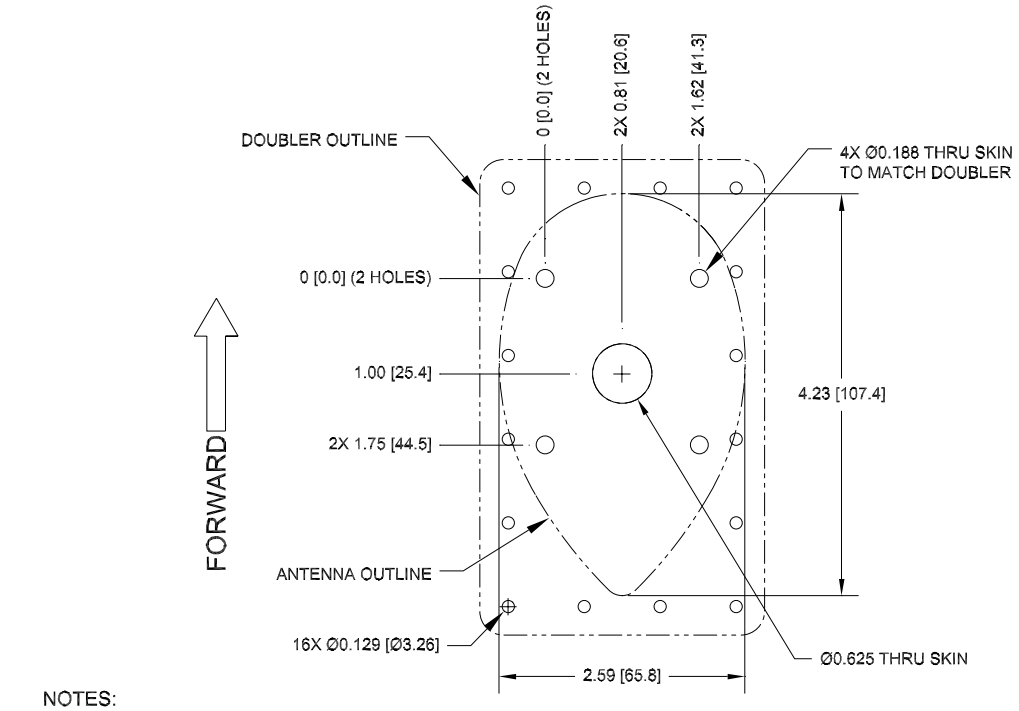
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-8. Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



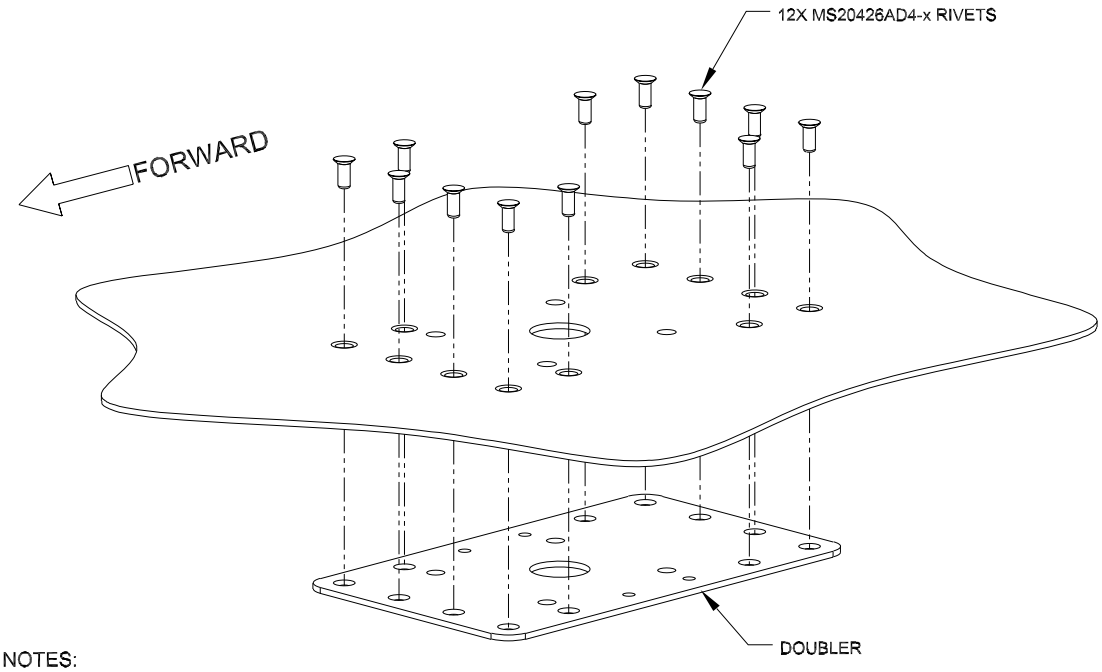
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-9. Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



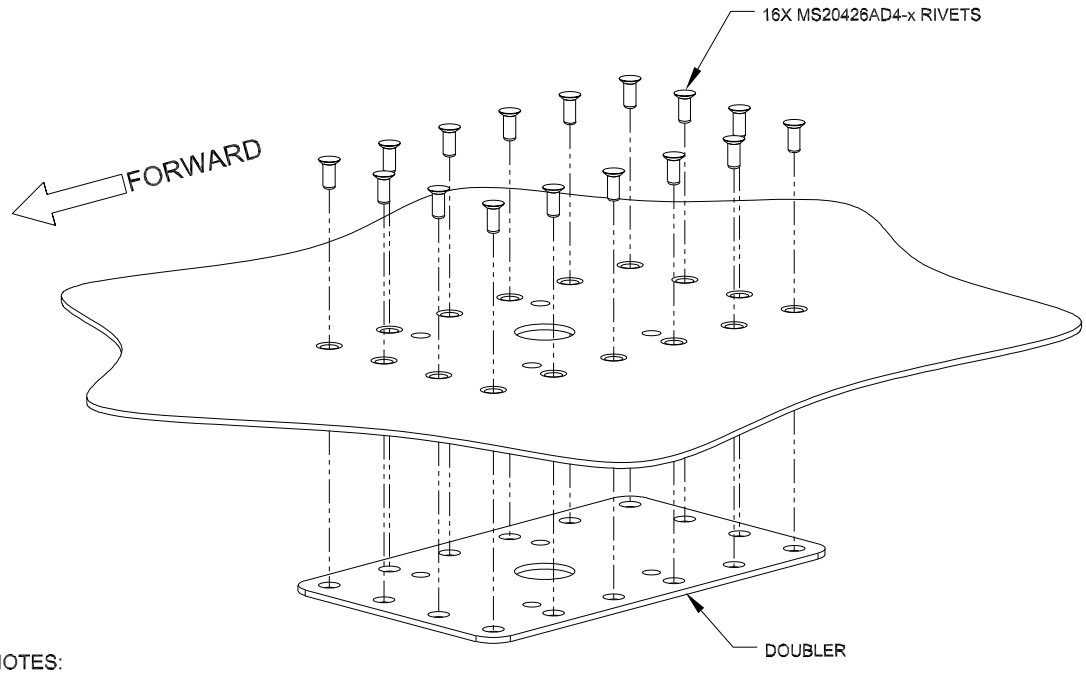
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-10. Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"



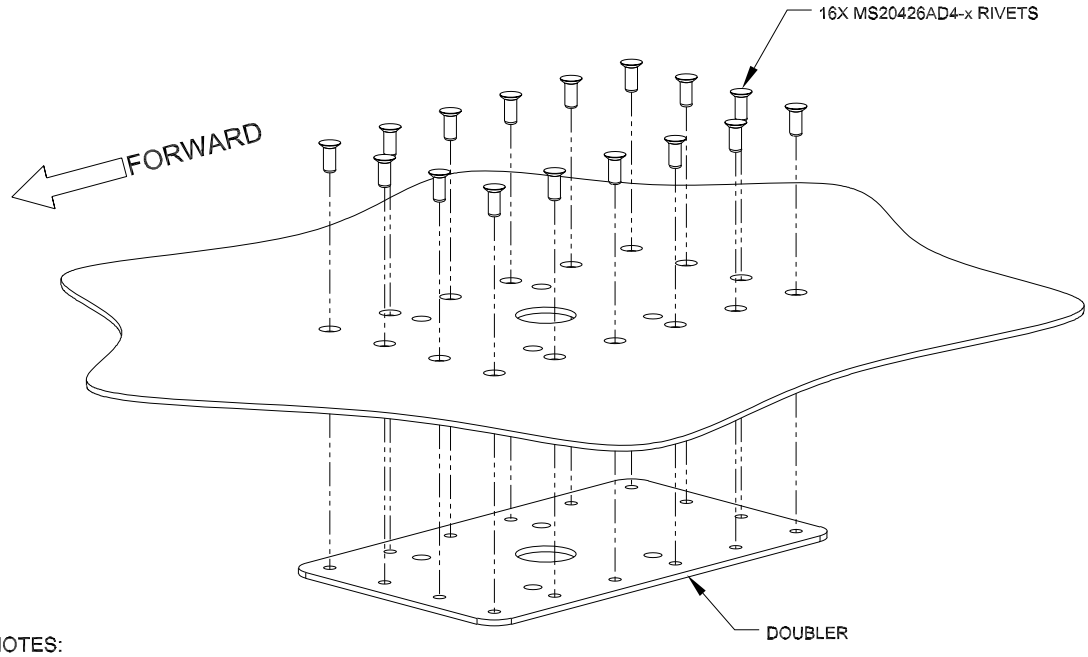
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-11. Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-12. Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-13. Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

6.5 ARINC 743 Footprint Antenna Installation (GA 55A, GA 57X)

This section describes the structural mounting of the ARINC 743 footprint antenna (GA 55A, GA 57X) installation. One acceptable method is to use Garmin P/N: 115-00846-00 doubler plate. Another acceptable method is to fabricate and install one of three doublers, Figure 6-14, Figure 6-15, or Figure 6-16, depending on the thickness of the skin. The three doubler designs vary only by number of rivets and hole preparation for installation with flush rivets. Figure 6-24 shows installation of the ARINC 743 footprint antenna.

Table 6-6 provides a summary of design and installation details for the antenna doubler. Figure 6-17 shows an example of the doubler installed between stringers on the top fuselage skin, just off centerline. The location should be flat, with no gaps between the skin and doubler, to keep from deforming the skin during installation.

Table 6-6. ARINC 743 Footprint Antenna Doubler Design and Installation

Skin Thickness	**0.032" to 0.049"**	**0.049" to 0.051"**	**0.051" to 0.063"**
Doubler Design (Figure)	Figure 6-14	Figure 6-15	Figure 6-16
Number of Rivets Required	12	16	16
Type of Rivets Required[1]	MS20426AD4-x	MS20426AD4-x	MS20426AD4-x
Skin Preparation for Rivets	Dimple	Dimple	Countersink
Doubler Preparation for Rivets	Countersink	Countersink	None
Skin Cutout Detail (GA 55A)	Figure 6-18	Figure 6-19	Figure 6-20
Doubler Installation (Figure)	Figure 6-21	Figure 6-22	Figure 6-23

Notes:

1. Rivet length determined at installation, dependent on thickness of material (rivet length = grip length + 1.5*rivet diameter)

6.5.1 Preparation of Doubler

1. Use Garmin P/N: 115-00846-00, or refer to Table 6-6 for guidance on selecting the appropriate doubler drawing based on the thickness of skin at the antenna location. Make the doubler from 2024-T3 Aluminum (AMS-QQ-A-250/5), 0.063" sheet thickness.

2. For installation in aircraft skins of thickness less than 0.051", countersink the rivet holes in the doubler for use with flush head rivets (MS20426AD4-x).

3. When using Garmin P/N: 115-00846-00 doubler, sixteen rivet holes exist in the part. For installation of Garmin P/N: 115-00846-00 in skins of thickness between 0.032" and 0.049", only the rivets identified for use through the skin cutout detail (Figure 6-18) and doubler installation (Figure 6-21) are required.

6.5.2 Antenna Installation Instructions

1. Refer to Table 6-6 (and to Figures in Appendix C) for guidance on selecting the appropriate mounting cutout. Drill or punch the holes to match the mating part (doubler).

2. Install a doubler plate to reinforce the aircraft skin, as required. Refer to Section 6.5.1 for doubler preparation and Table 6-6 for additional guidance on the doubler installation. Dimple aircraft skin when the skin thickness is less than 0.051" for installation of flush head rivets. Countersink aircraft skin when the skin thickness is between 0.051" and 0.063" for installation of flush head rivets.

3. Place the install gasket on top of aircraft skin using the four screw holes to align the gasket.

4. Locking nuts are required to secure the antenna (locking nuts installed on doubler). Torque the four supplied #10-32 stainless steel screws (Garmin P/N: 211-60212-20, MS51958-67, or equivalent) 20-25 in-lbs. Torque should be applied evenly across all mounting studs to avoid deformation of the mounting area.

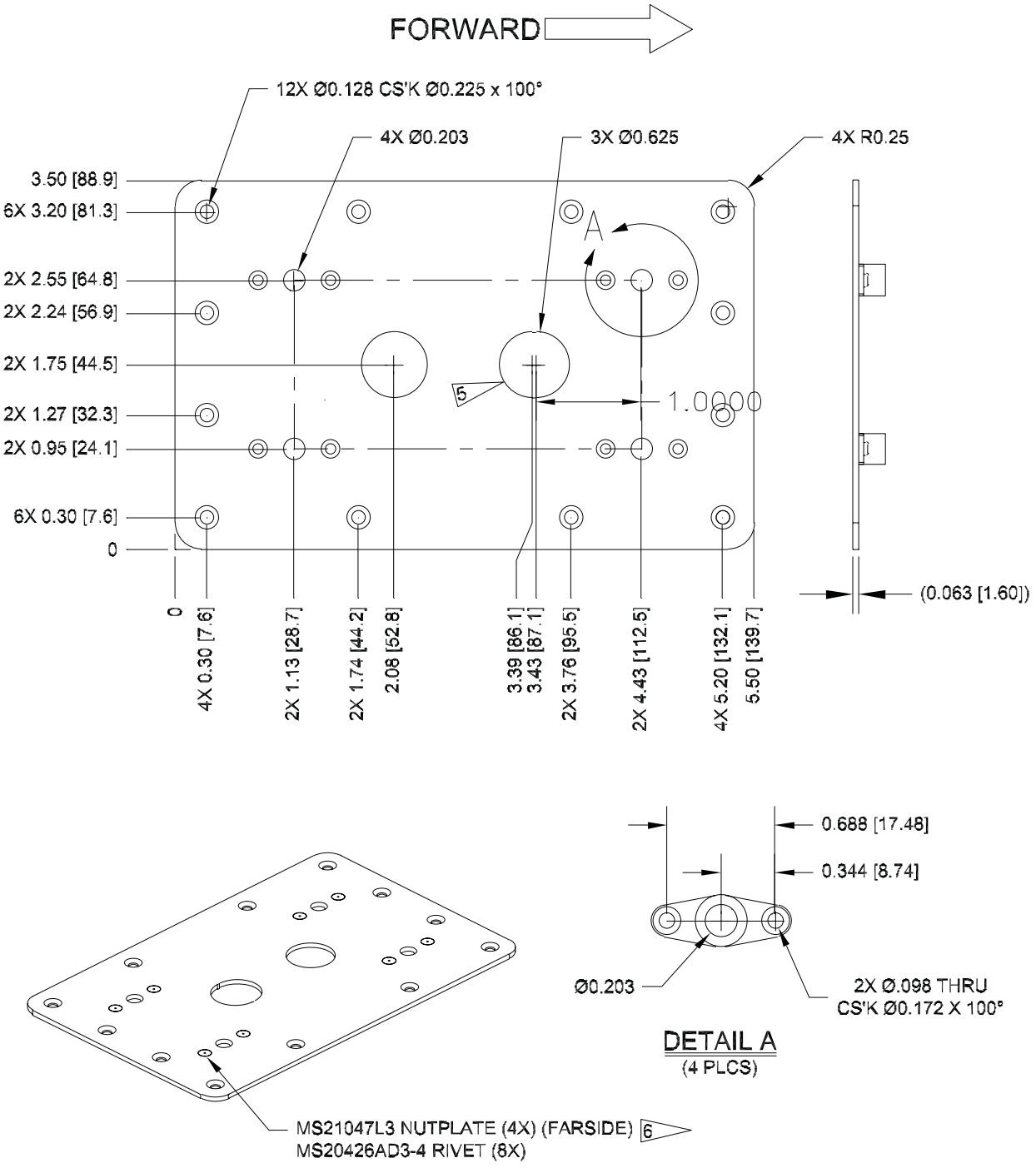
5. Ensure that the antenna base and aircraft skin are in continuous contact with the gasket.

6. Seal the antenna and gasket to the fuselage using Dow Corning 738 Electrical Sealant or equivalent. Run a bead of the sealant along the edge of the antenna where it meets the exterior aircraft skin. Use caution to ensure that the antenna connectors are not contaminated with sealant.

CAUTION

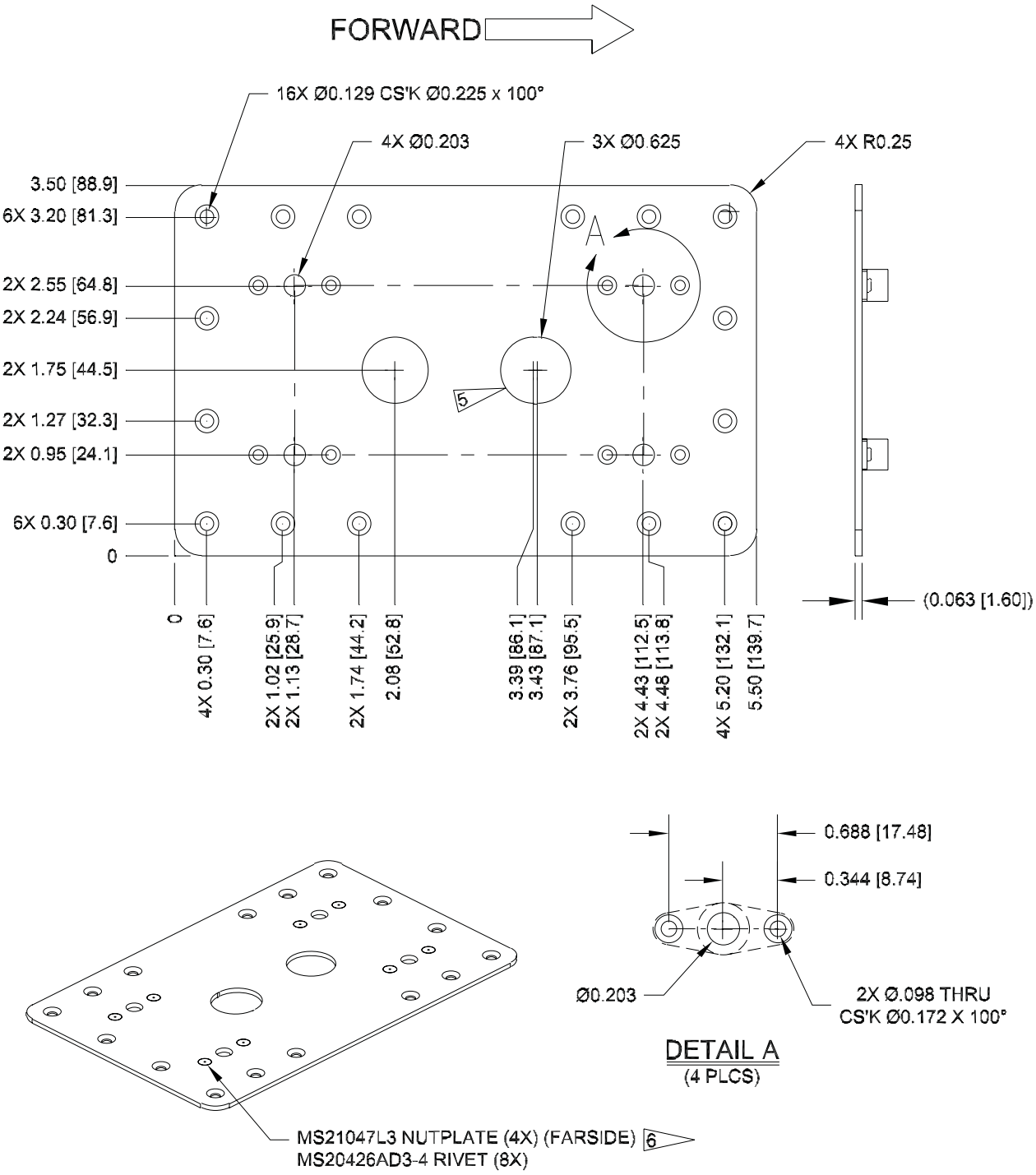
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

6.5.3 Reference Figures



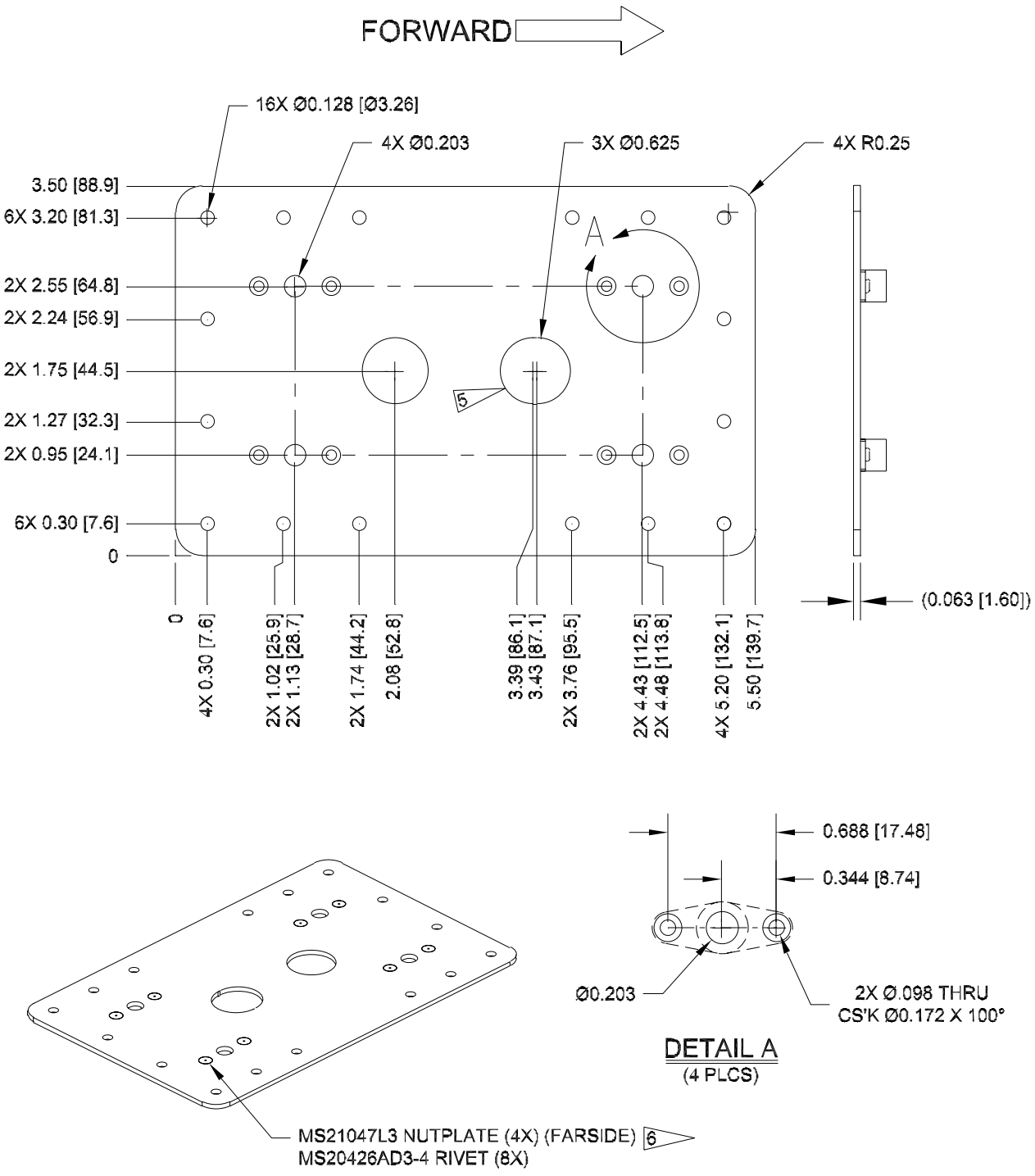
NOTES:
1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 6-14. Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL. GA55A ANTENNA INSTALLATION
6. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 6-15. Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:

1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 6-16. Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063"

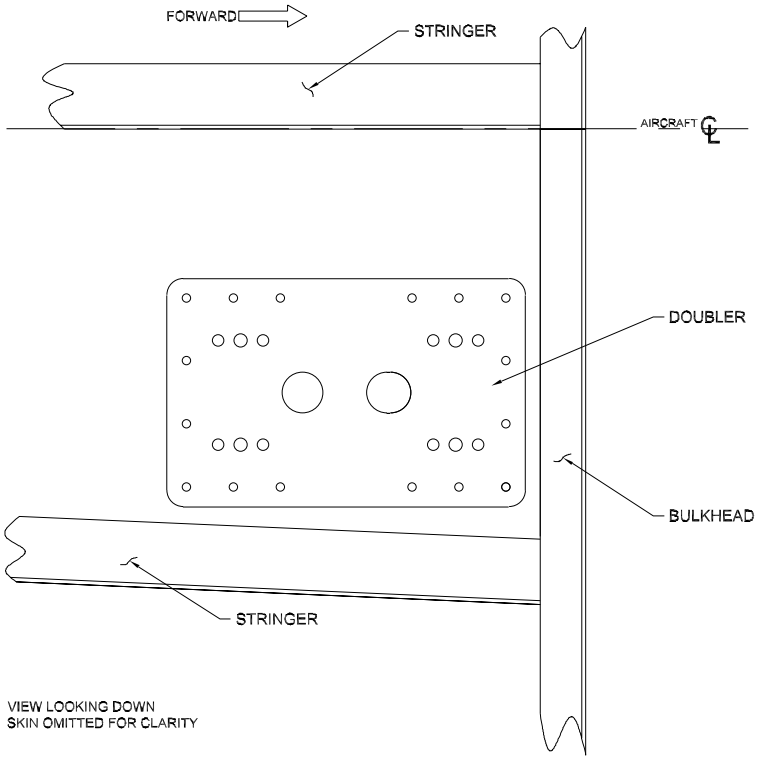


Figure 6-17. Sample Doubler Location, ARINC 743 Antenna, Metal Skin Aircraft

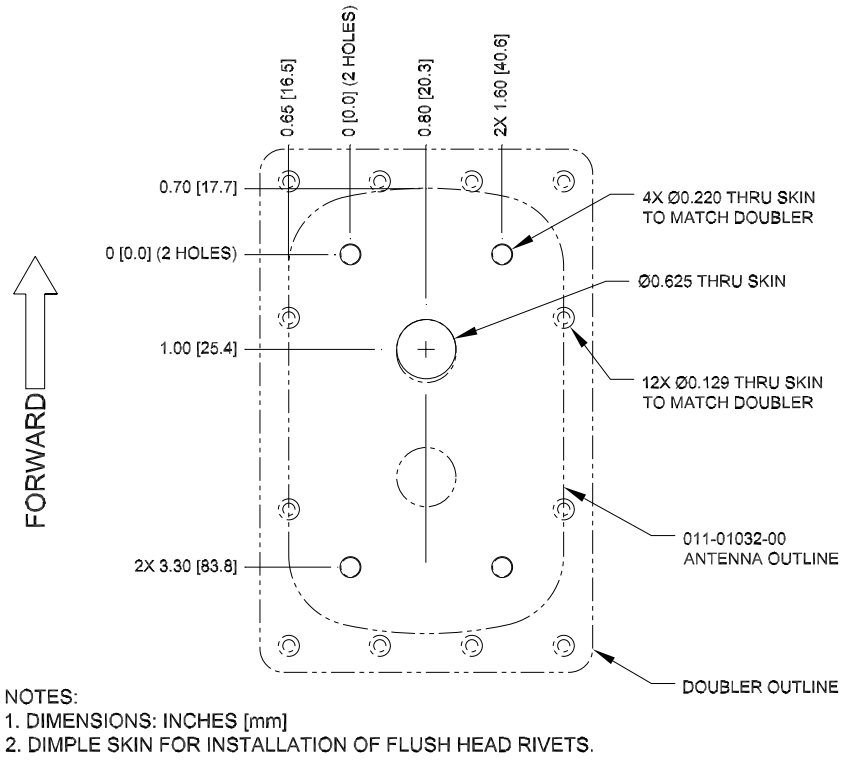


Figure 6-18. Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"

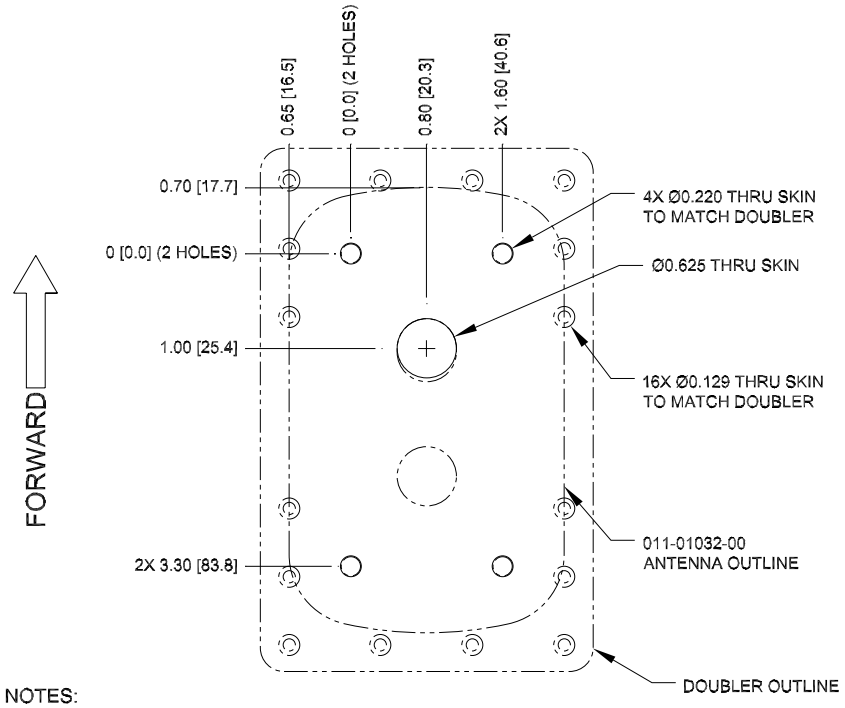


Figure 6-19. Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"

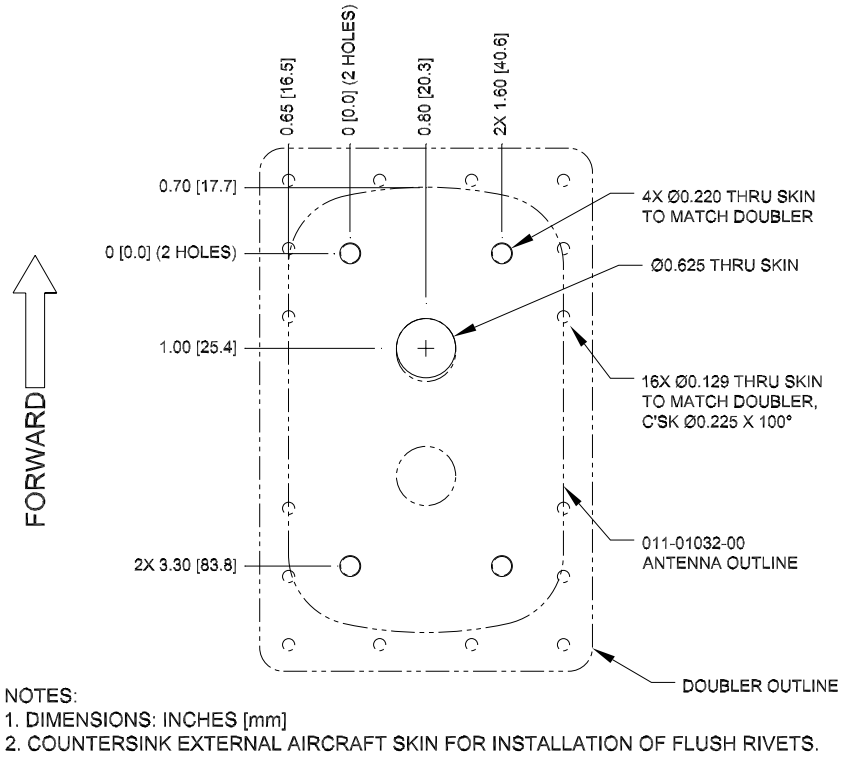
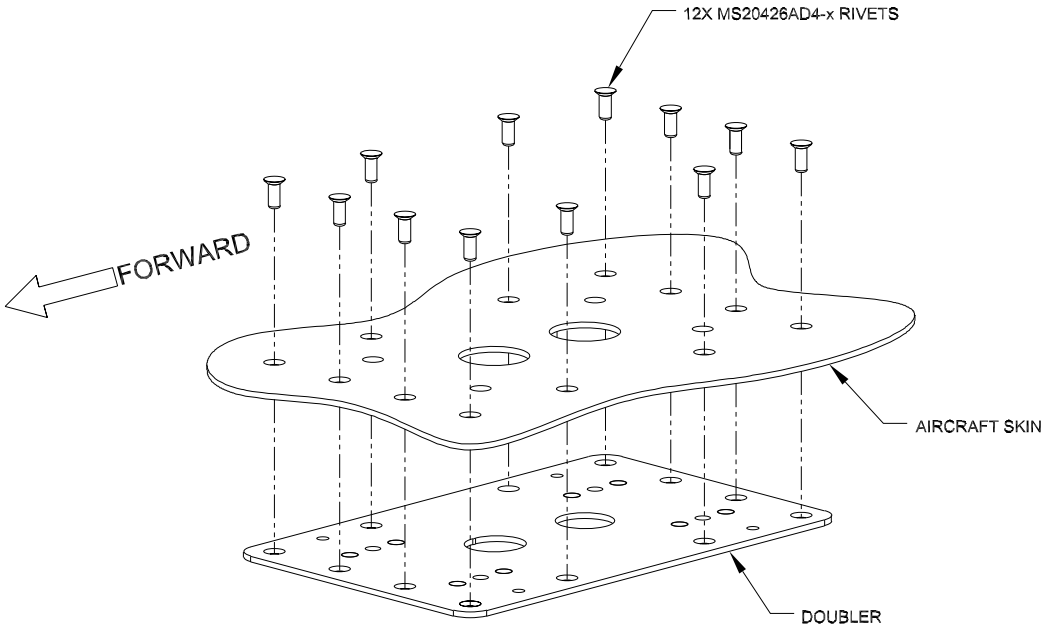
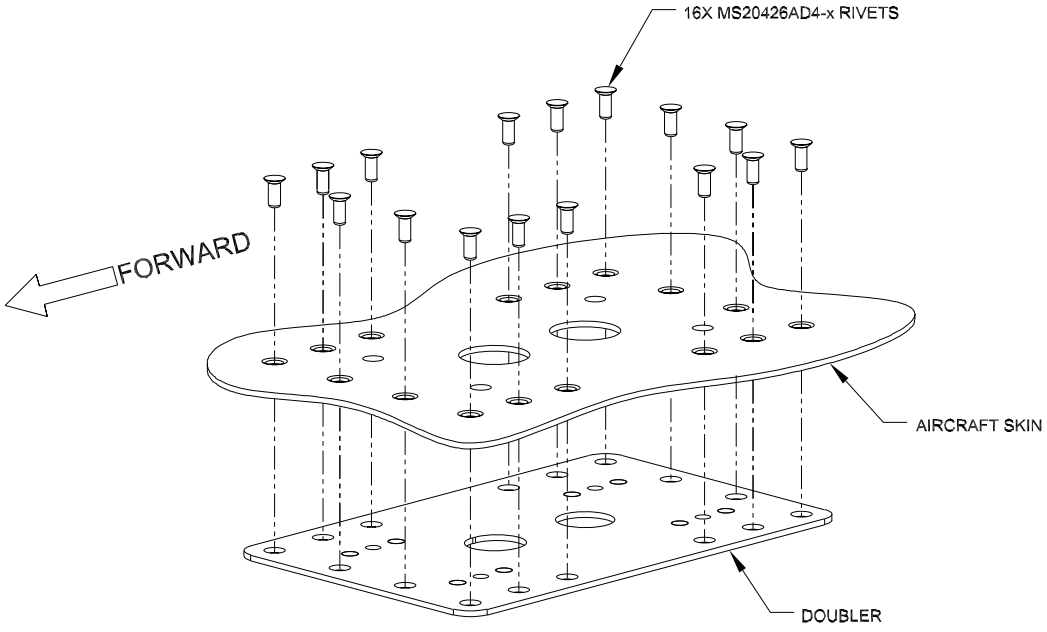


Figure 6-20. Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063"



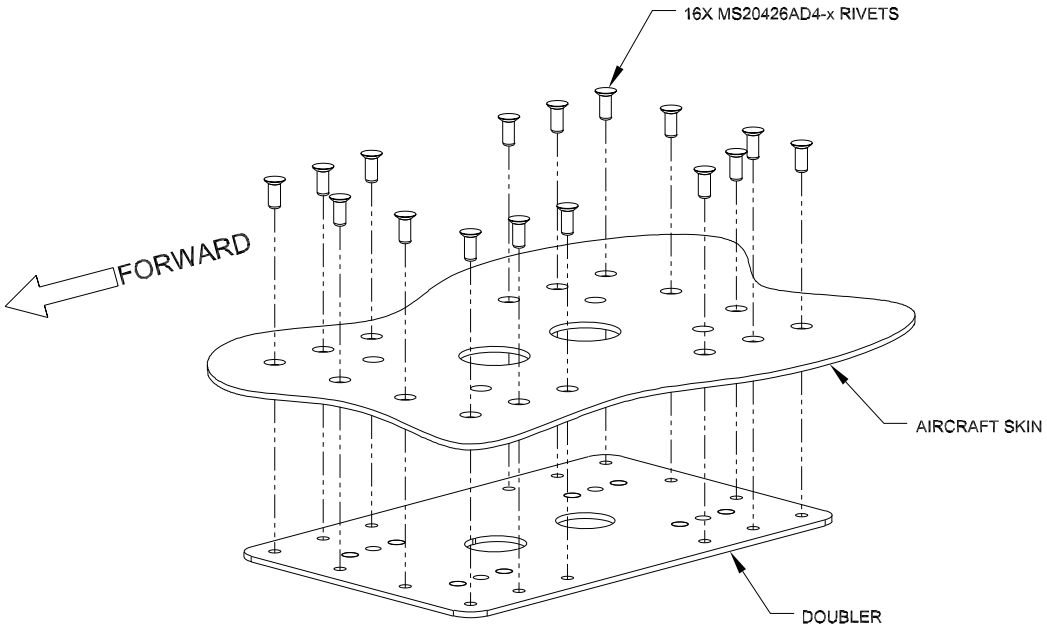
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-21. Doubler Installation, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-22. Doubler Installation, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-23. Doubler Installation, ARINC 743 Footprint, Skin Thickness 0.051" to 0.063"

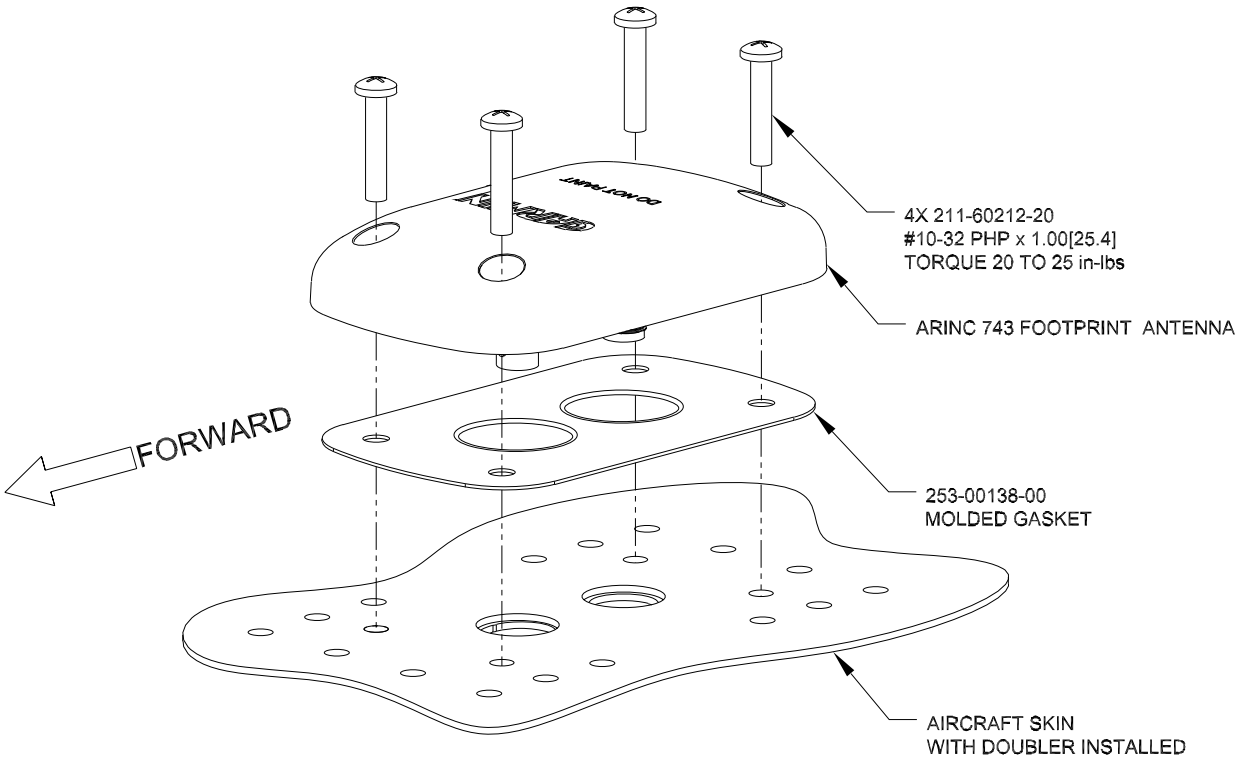


Figure 6-24. Installation of ARINC 743 Footprint Antenna

6.6 Non-Structural Mount Installation

This section provides installation examples and considerations for non-structural mounting of teardrop and ARINC 743 footprint antennas. Typical installations may be below a non-metallic glareshield, under the composite or fabric skin, or on an external, non-structural surface. Other non-structural installations may exist, but are not presented in this manual.

6.6.1 Generic Non-structural Antenna Installation

Figure 6-25 shows the generic non-structural installation for the ARINC 743 footprint (GA55A/GA 57X) antenna. The teardrop footprint antennas (GA55, GA56 stud mount) can also be installed in this manner.

For mounting the teardrop style antenna (GA 55 or GA56), a doubler plate similar to Figure 6-4 or P/N 115-00846-10 can be used with the mounting surface to support the antenna. Rivets used to secure the doubler plate to the mounting surface are optional in a non-structural installation. Screws, washers, and locking nuts as shown in Appendix C are required to secure the Teardrop style antenna to the mounting surface. Torque the locking nuts to 12-15 in-lbs, torque should be applied evenly across all mounting studs.

A doubler plate similar to Figure 6-14, or P/N 115-00846-00 (ARINC 743 style) can be used with the mounting surface to support the antenna. Rivets used to secure the doubler plate to the mounting surface are optional in a non-structural installation. Locking nuts are required to secure the ARINC 743 antenna (locking nuts installed on doubler). Torque the four supplied #10-32 stainless steel screws (Garmin P/N: 211-60212-20, MS51958-67, or equivalent) evenly across all mounting screws.

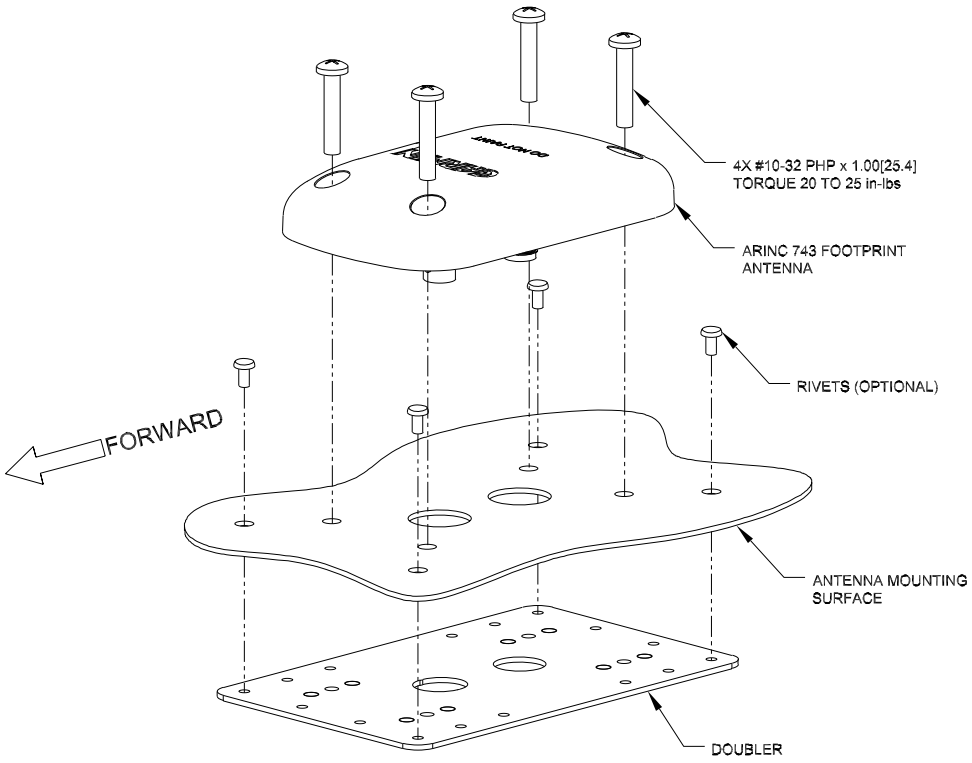


Figure 6-25. Generic Non-structural ARINC 743 Footprint Antenna Installation

6.6.2 Considerations for Non-Structural Mounting

External mounting of the antenna is preferred, although the antenna can be mounted inside the aircraft. When mounted internally, the antenna does not have to be aligned with the aircraft forward direction, but should be equal to the aircraft typical cruise attitude.

There should be a solid mechanical base in the mounting area for the antenna, and existing surfaces or brackets may be used with the doubler plate. Alternately, non-structural brackets may be fabricated in the field as necessary to mount the antenna. Brackets should be made of minimum 0.032" thickness aluminum and should span as short a distance as possible.

Some fabric aircraft include aluminum paste in the fabric finishing process, often referred to as "silver coats". Presence of thick fabric and/or heavy "silver coats" may degrade the signal strength of the antenna.

6.6.3 Non-structural Installation to Glareshield

Figure 6-26 shows an example of a bracket created to support an antenna mounted on the underside of the glare shield. Figure 6-27 shows the non-structural mounting of the antenna under the glareshield, with the bracket assembly shown in Figure 6-26.

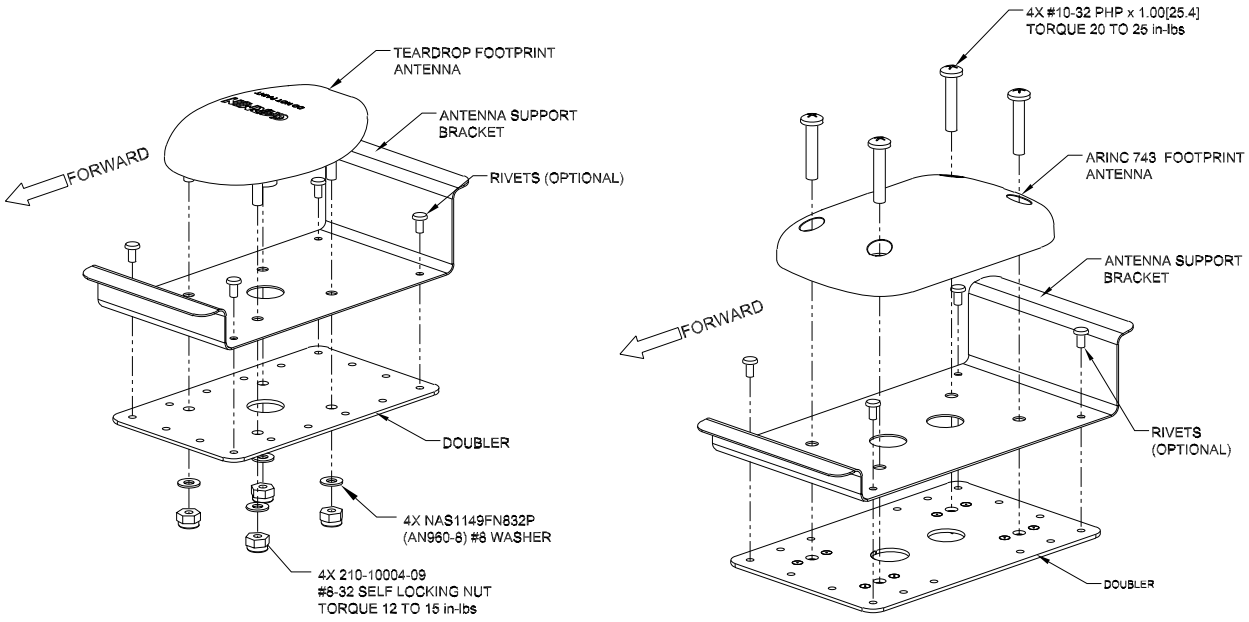


Figure 6-26. Example Bracket Antenna Mounting Under Glareshield

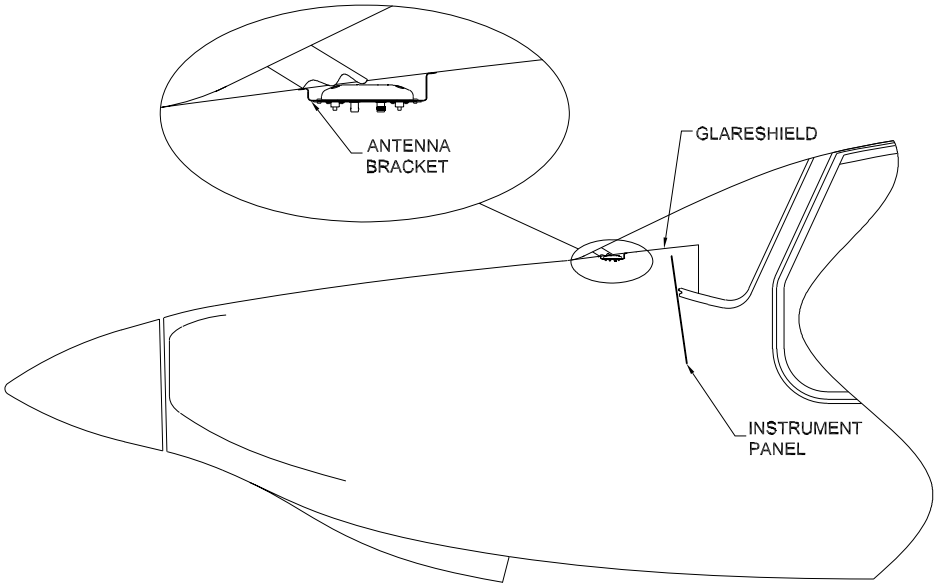


Figure 6-27. Example Non-structural Antenna Mounting Under Glareshield

6.6.4 Non-structural Installation to Airframe

Internal Non-structural Installation

Figure 6-28 and Figure 6-29 show examples of under the fabric skin non-structural mounting of the antenna to the airframe of a tube-and-fabric aircraft.

In Figure 6-28, a bracket is made to attach to the airframe, just under the fabric for a teardrop antenna installation. The doubler plate and mounting hardware described in the generic installation (Section 6.6.1) are used with the bracket as the antenna mounting surface. In Figure 6-29, a similar case is shown using the generic installation of the ARINC 743 footprint antenna. The doubler plate is optional for this type of installation with either the Teardrop or the ARINC 743 antenna.

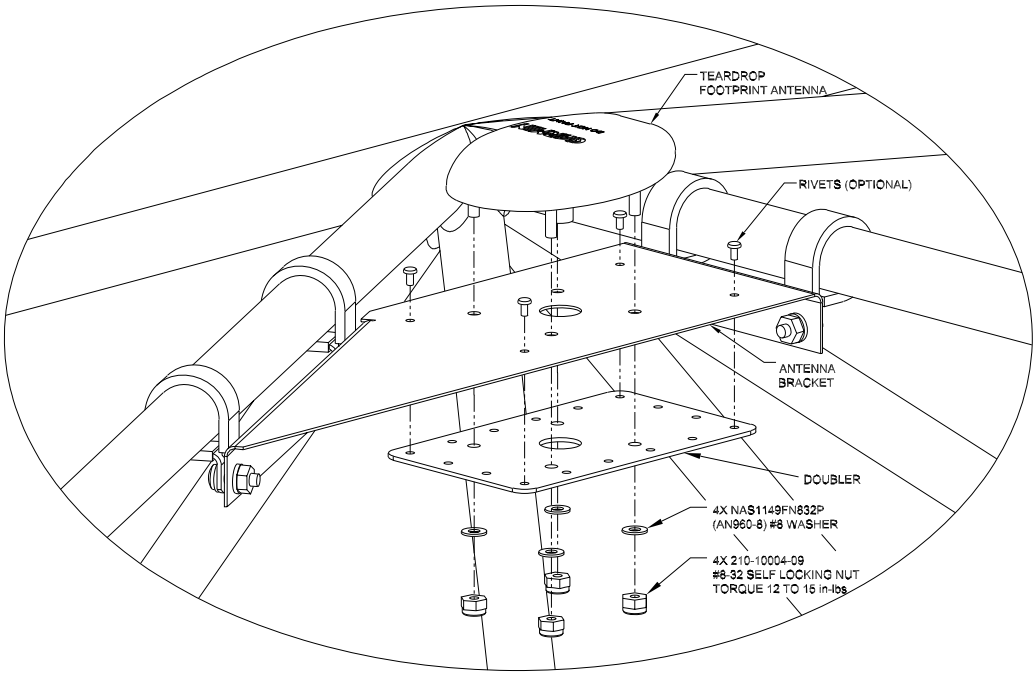


Figure 6-28. Example Teardrop Antenna Installation In Airframe Under Fabric Skin

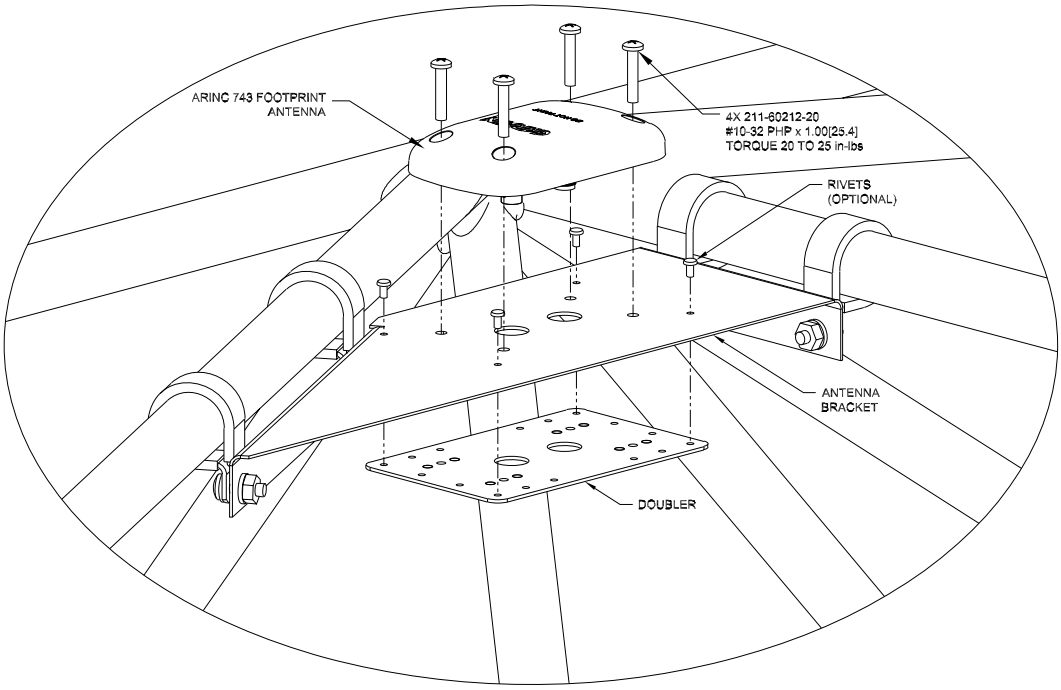


Figure 6-29. Example ARINC 743 Footprint In Airframe Under Fabric Skin

External Non-structural Installation

Figure 6-30 is an example of an external, non-structural mounting of the antenna in a tube-and-fabric aircraft. The antenna support bracket shown should be made of 2024-T3 Aluminum with a minimum material thickness 0.032" and maximum distance between airframe tubes of 36". The bracket is installed to the airframe under the fabric, and the antenna is mounted externally to the bracket. The generic installation of the (Section 6.6.1) antenna is used, with the antenna support bracket as the mounting surface. Follow the applicable gasketing and sealant instructions in Section 6.4.2 (Teardrop style) or Section 6.5.2 (ARINC 743 style).

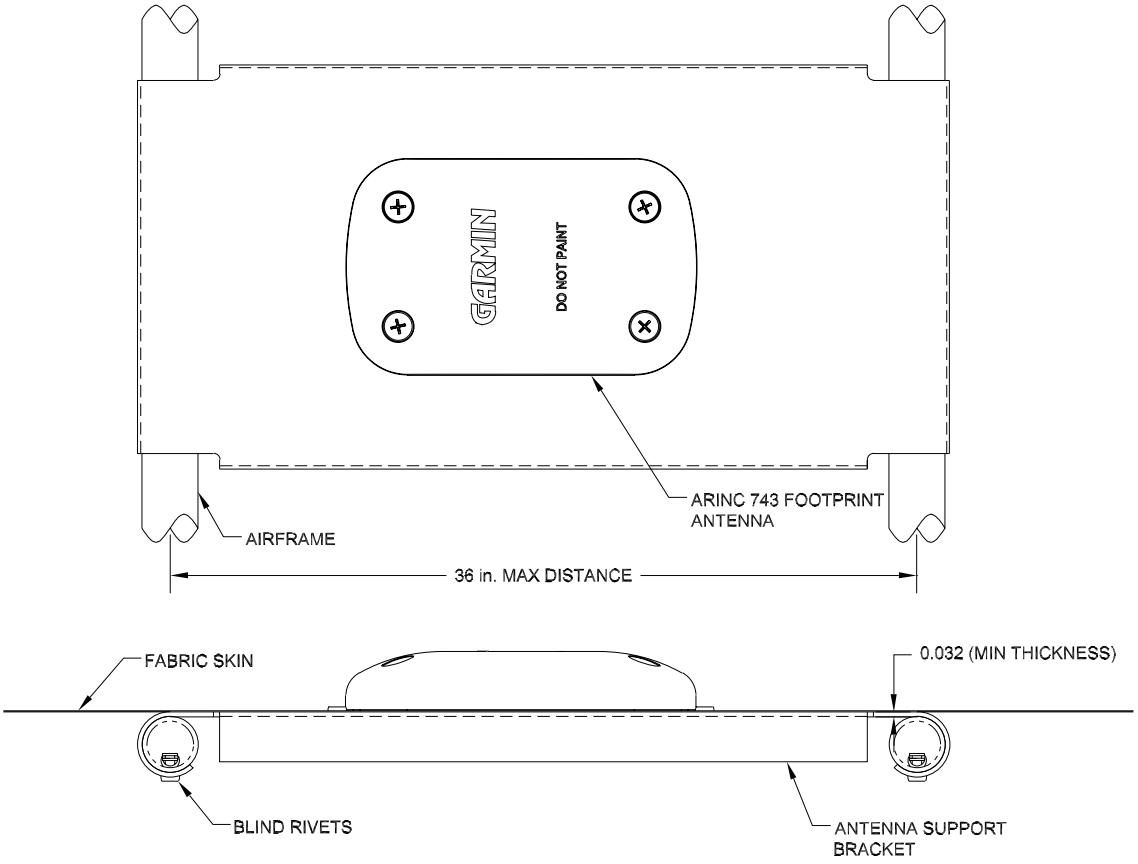


Figure 6-30. Example Non-structural Antenna Mounting On Airframe

Minimum Distance from Metal Tube Structure Requirements

Figure 6-31 shows minimum distance from metal tube structure requirements for internal, non-structural mounting of the antenna. Table 6-7 presents minimum distance requirements between the tube structure and the antenna for cases where the antenna sits underneath the fabric in a metal-tube structure aircraft. Figure 6-31 illustrates the tube diameter (**d**) and minimum distance (**l**) references in the table.

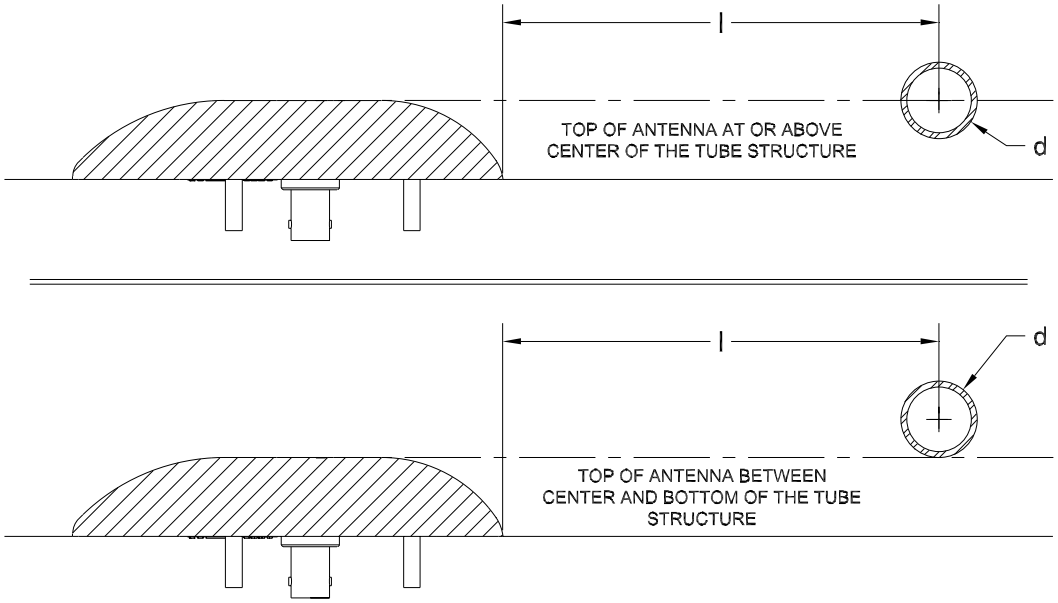


Figure 6-31. Example Teardrop Footprint Antenna Mounting Under Fabric Skin

Table 6-7. Minimum Distance Required Between Tube Structure and Antenna

Illustrated Case	Tube Diameter d (in)	Minimum Distance l (in)
Top of antenna at or above the center of the tube structure (Figure 6-31, top)	0.625	3.6
	0.75	4.3
	1.00	5.7
	1.25	7.2
Top of antenna between the center and bottom of the tube structure (Figure 6-31, bottom)	0.625	7.2
	0.75	8.6
	1.00	11.5
	1.25	14.3

7 Software, Configuration, Databases, and XM Activation

7.1 Configuration Mode

Some software loading and all configuration settings are performed in the configuration mode. To enter configuration mode, hold down the left-hand softkey (softkey #1) while powering on the GDU 37X. If more than one GDU 37X is installed, hold down softkey #1 on PFD1.

7.2 Software/Audio Data Identification

7.2.1 LRU Software Version Identification

Do the following steps to verify the unit's current software version(s):

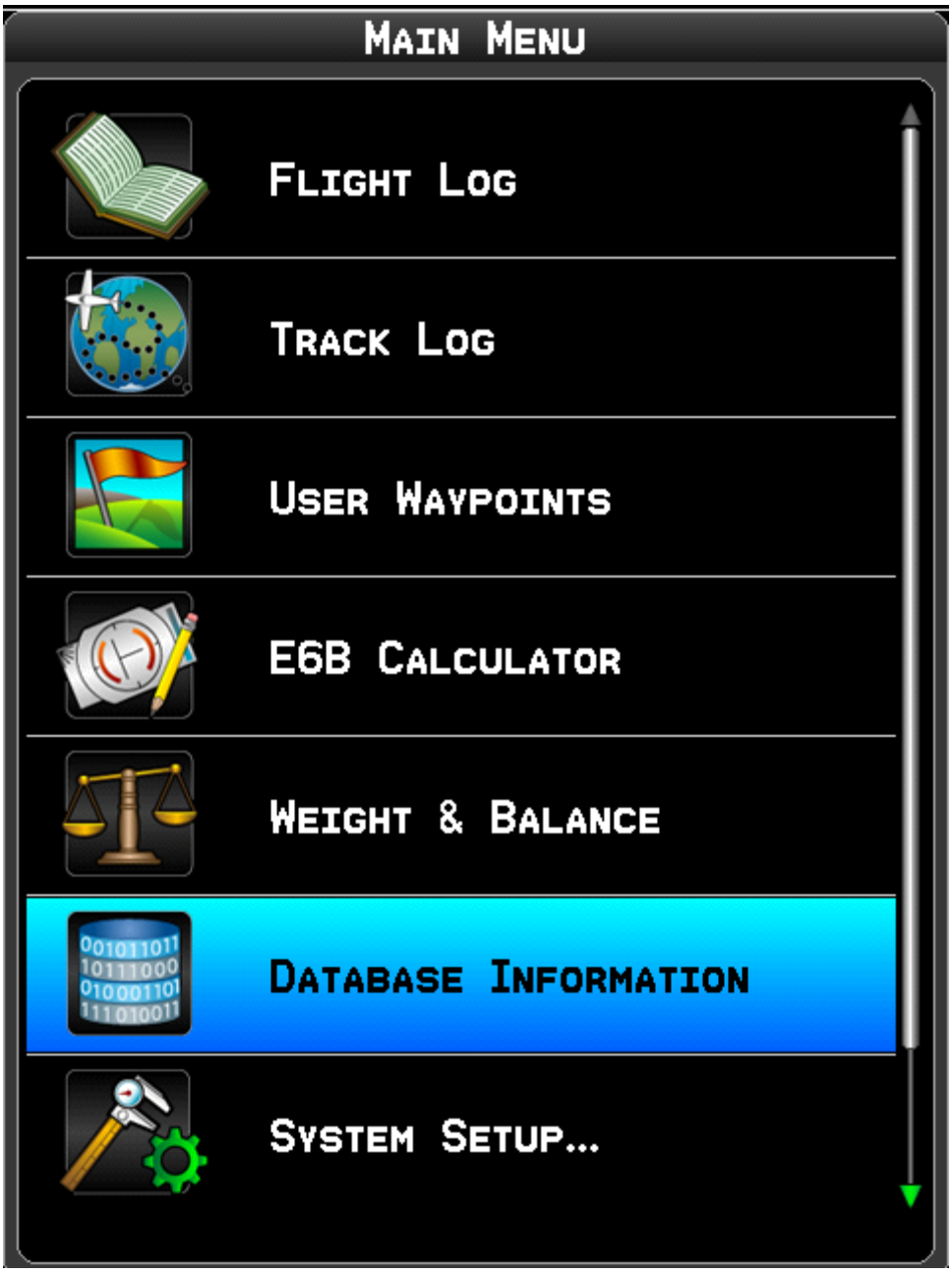
1. Turn on the unit in configuration mode.
2. Use the FMS Joystick to select the CONFIG MAIN page (if needed).

3. Note the displayed software version.

7.2.2 Audio Data Identification

Do the following steps to view the unit's current audio data information:

1. Turn on the unit in normal mode.
2. Press the MENU key twice to display the Main Menu
3. Use the FMS Joystick to select Database Information



4. Press the ENT key to display the Database Information page.
5. Use the FMS Joystick to scroll down as needed to display the audio database information.

7.3 Software Loading Procedure

Software loading is performed in normal mode. Sections 7.3.1 and 7.3.2 describe the GDU and GSU software load procedure.

7.3.1 GDU Software Loading Procedure

1. Power on the GDU in normal mode, then insert the properly formatted SD card into the SD card slot.

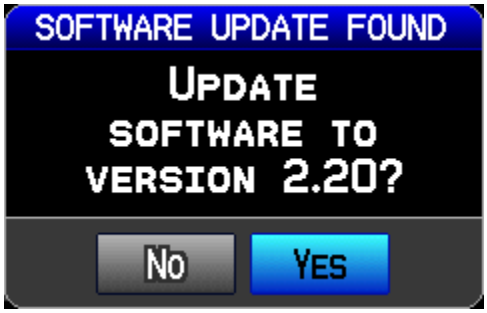
NOTE

It is also acceptable to insert the SD card before powering on the unit.

2. A software update pop-up will appear on the screen, highlight YES and press the ENT key to begin the update.

NOTE

If the below software update pop-up does not appear, select the Database Information Menu to update the software.



3. The unit will reboot, then GDU software update will begin automatically.
4. Ensure power is not removed while the update is being performed
5. The unit will reboot after the update is complete.

7.3.2 GSU Software Loading Procedure

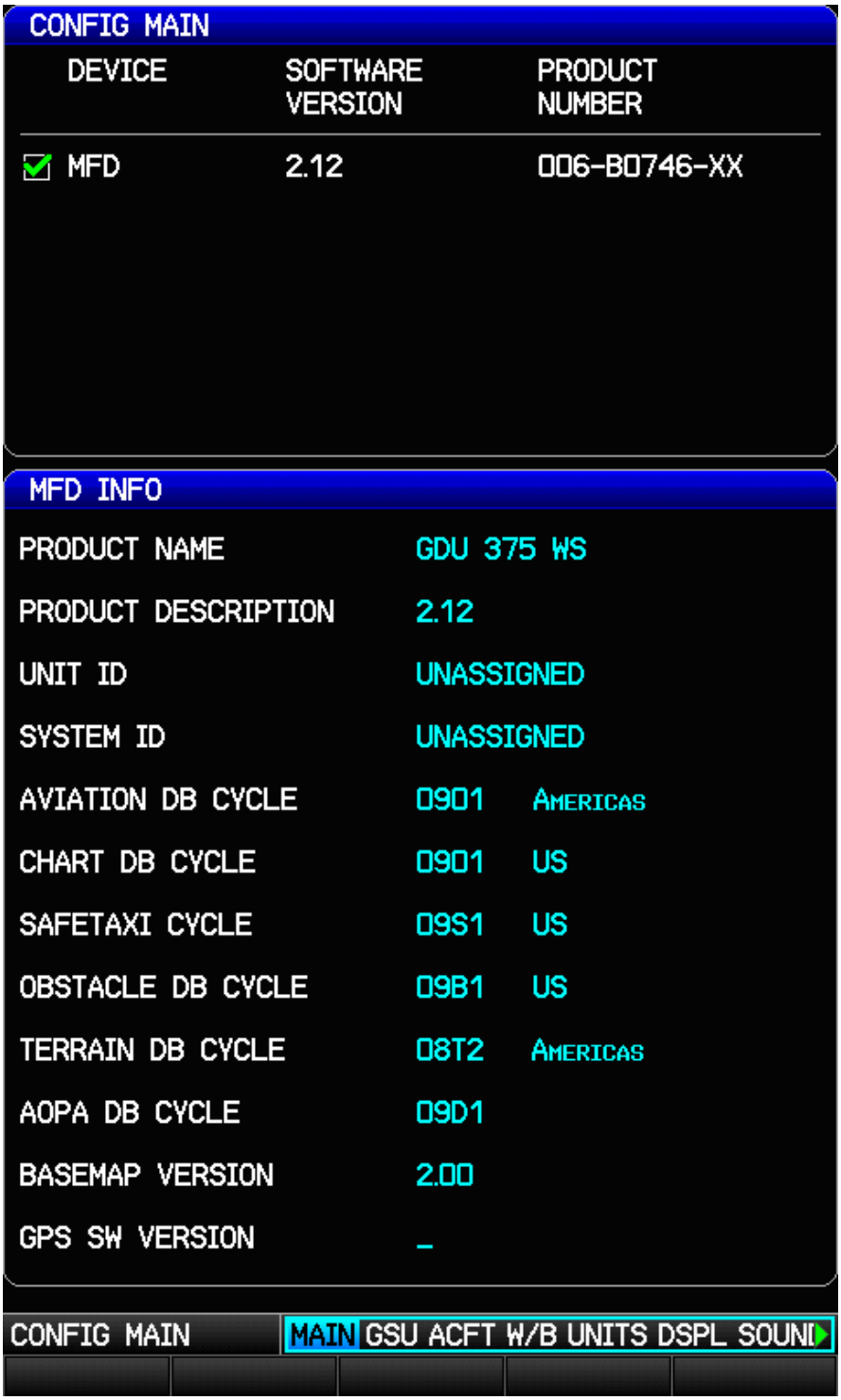
1. Power on the GDU in configuration mode.
2. Use the FMS Joystick to select the GSU Page.
3. Press the UPDATE SW softkey, then press the ENT Key to begin the update.

7.4 Configuration Pages

7.4.1 Main Configuration Page

The Main Configuration Page is used to display LRU (device) specific information such as Unit and System ID's and Database information for the various databases used by the G3X. This page has no user-selectable options.

1. In configuration mode, use the FMS Joystick to select and view the MAIN Page.



7.4.2 ACFT Configuration Page

The Aircraft Configuration Page allows setting the parameters for Flight Planning, Aircraft Identifier, and Map Symbol. The aircraft's cruise speed, fuel flow, aircraft identifier, and map symbol can be entered on this page.

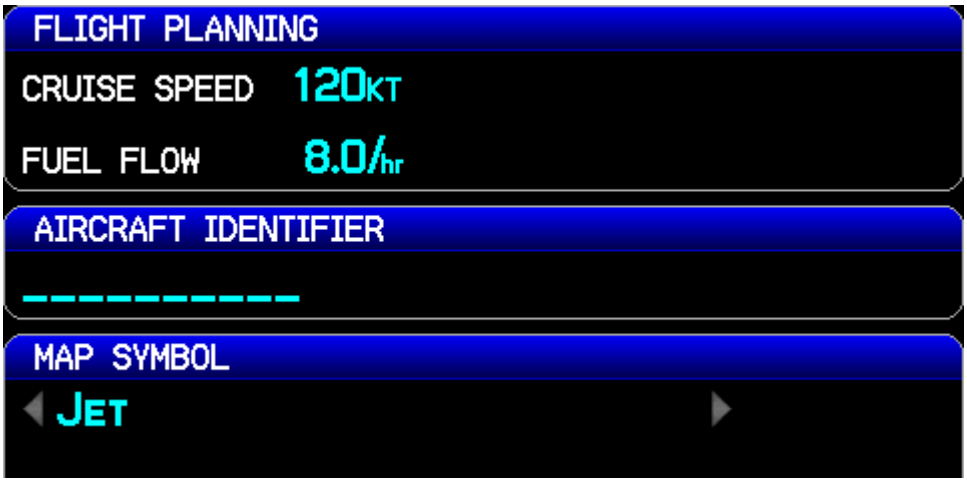
The flight planning fields let you adjust the default values (cruise speed and fuel flow) used for flight planning calculations.

Aircraft Identifier–The aircraft identifier can be entered using the FMS Joystick.

Map Symbol– The aircraft symbol that is displayed on the Map page can be selected.

1. In configuration mode, use the FMS Joystick to select the ACFT Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



7.4.3 W/B (Weight/Balance) Configuration Page

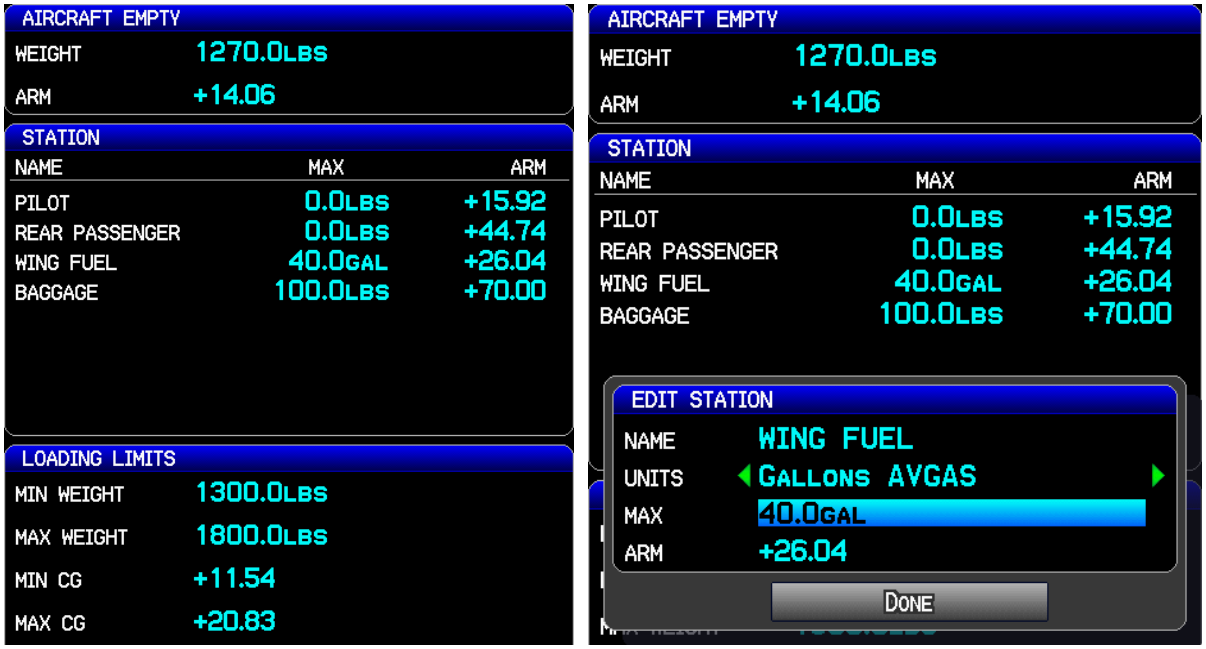
The W/B Configuration Page allows setting the weight and balance parameters for the airplane, these parameters are then used on the Main Menu W/B Page in normal mode. Weight/Balance may be used during pre-flight preparations to verify the weight and balance conditions of the aircraft. By entering the weight and arm values into the Aircraft window, the GDU 37X can calculate the total weight, moment, and center of gravity (CG).

Before entering the various figures, the empty weight of the airplane and the arm (or "station") for each weight should be determined. These figures should be determined using the pilot's operating handbook for the airplane, which also notes the weight limitations and fore/aft CG limits. Compare those figures to the values calculated by the GDU 37X.

Each station listed in the Station window has an editable name and arm location. This allows the setting of the units of measure used for that station (weight, or units of avgas or jet fuel). An optional maximum value can be set for a particular station (e.g. a fuel tank might have a max capacity of 50 gallons) or the max can be set to zero so that no maximum will be imposed.

The LOADING LIMITS window contains fields for the entry of minimum and maximum aircraft weight, and the minimum and maximum CG location.

1. In configuration mode, use the FMS Joystick to select the W/B Page.



2. Use the FMS Joystick to select the desired configurable item and make the desired change, then press the ENT Key or use the FMS Joystick to select the next item.

3. To create a new station, press the NEW softkey, enter the name, units, max weight, and arm, then highlight DONE and press the ENT key.

4. To edit or delete a station, highlight the desired station, then press the edit or delete softkey.

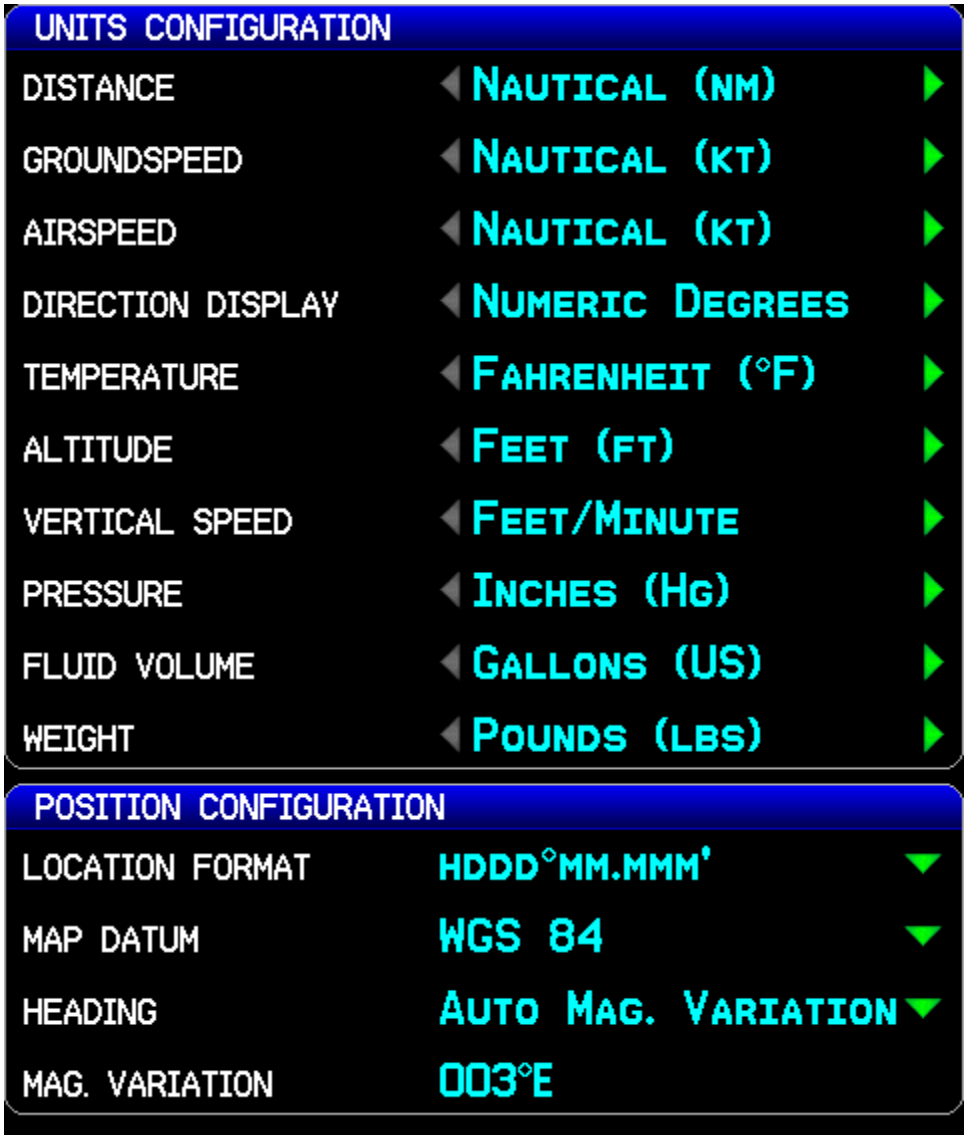
5. Press the FMS Joystick to move the cursor to the page selection menu when finished.

7.4.4 UNITS Configuration Page

The Units Configuration Page allows selection of the desired displayed units for the listed items in the Units Configuration window. The various settings for Location Format, Map Datum, and Heading can be accessed in the Position Configuration window. See the G3X Pilot's Guide for a description of Location Format and Map Datum.

1. In configuration mode, use the FMS Joystick to select the UNITS Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.

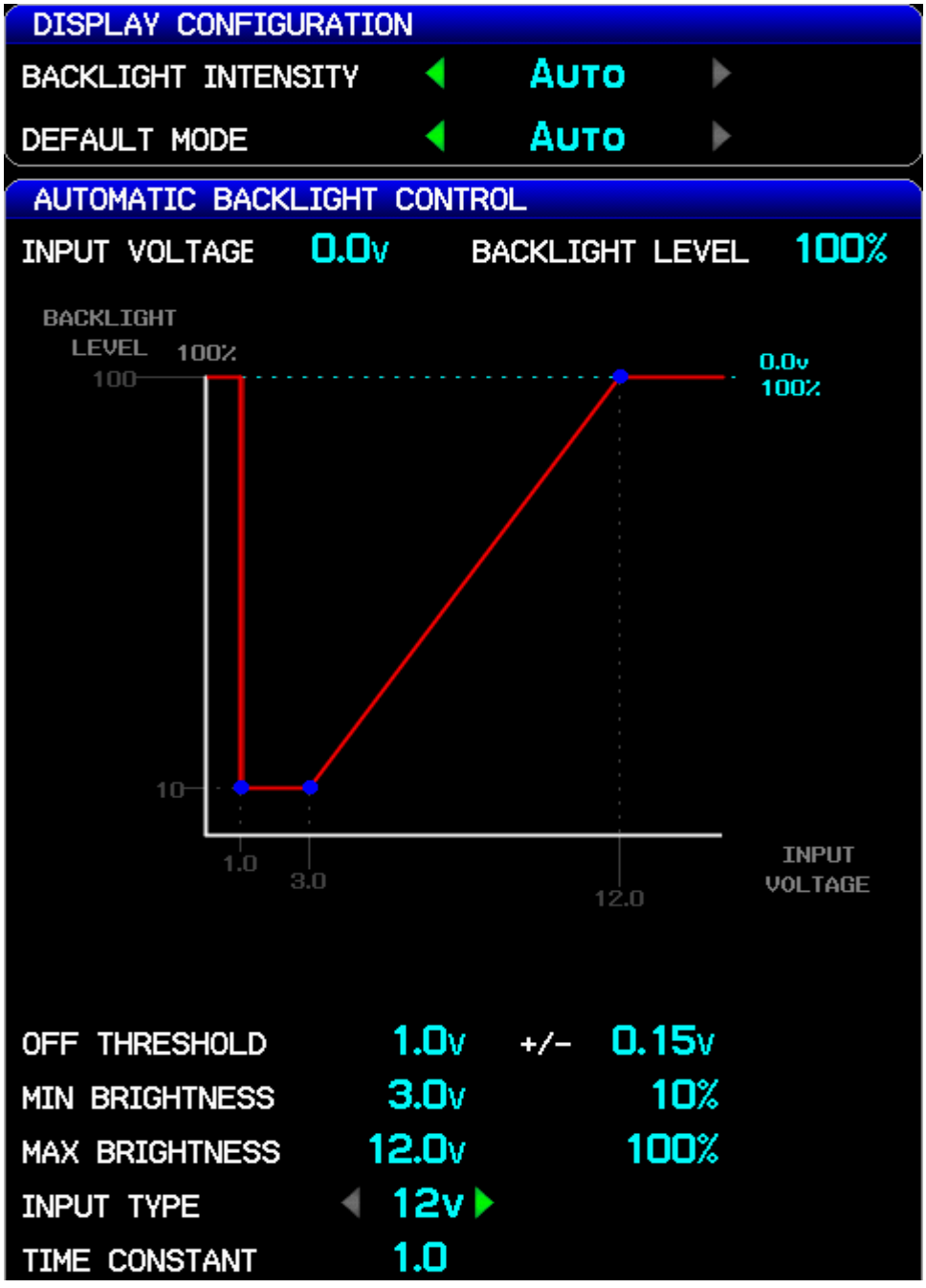


7.4.5 DSPL (Display) Configuration Page

The DSPL Configuration Page allows setting the parameters for Display and Backlight Control configuration.

1. In configuration mode, use the FMS Joystick to select the DSPL Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



7.4.5.1 Display Configuration Window:

Backlight Intensity: Can be set to Auto or Manual (this setting is also available in normal mode on the Display Setup page).

Auto–Sets the backlight intensity (display brightness) based on the aircraft's instrument lighting bus voltage.

Manual–Allows setting the display brightness by changing the Backlight Intensity (0-9) setting found beside the 'Manual' setting.

Default Mode: Can be set to Auto or Manual (described above). This controls the backlight mode that will be active each time the system is powered on.

7.4.5.2 Automatic Backlight Control Window (settings apply only to 'Auto' setting):

Input Voltage–Displays the current lighting bus voltage

Backlight Level–Displays the current backlight level (0-100%)

Graph–Brightness is displayed as the vertical (Y) axis, and aircraft lighting bus voltage is displayed as the horizontal (X) axis. The graph changes according to the auto backlight control settings, and the lighting bus voltage.

Off Threshold–Sets the lighting bus threshold voltage. At the threshold voltage, the backlighting is turned on per the Min Brightness setting. Below the threshold voltage, the backlighting defaults to a Backlight Level of 100% . The' ±' setting controls the range that the Off Threshold voltage is in effect. Default values are 2.9V & ±0.15V.

Min Brightness (Voltage and Percentage)–Sets the lower bus voltage required to turn the backlighting on to the percentage of brightness set by the Min % setting. Default values are 3.0V and 10%.

Max Brightness (Voltage and Percentage)–Sets the upper bus voltage required to turn the backlighting on to the percentage of brightness set by the Max % setting. Default values are 12.0V and 100%.

Input Type–Sets the aircraft lighting bus voltage for either 12 or 24V input to match the aircraft lighting bus voltage.

Time Constant–Adjusts the speed (in seconds), that the brightness level responds to changes in the input voltage level.

7.4.6 SOUND Configuration Page

The SOUND Configuration Page allows setting the parameters for various alert and message tones.

1. In configuration mode, use the FMS Joystick to select the SOUND Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.

The configuration options for the SOUND Configuration Page are listed/described as follows:

Alert Volume – Controls the volume level of audio alerts (settings 1-10)

Message Tones – Controls the volume level of message tones (settings 1-10)

Terrain Audio – Enables/disables terrain awareness audio alerts

TIS Audio – Enables/disables TIS traffic audio alerts

Alert Output – If set to MONO + STEREO, alert tones and messages will be output on both the mono and stereo outputs. If set to MONO ONLY, alert tones and messages will be output only on the mono output.

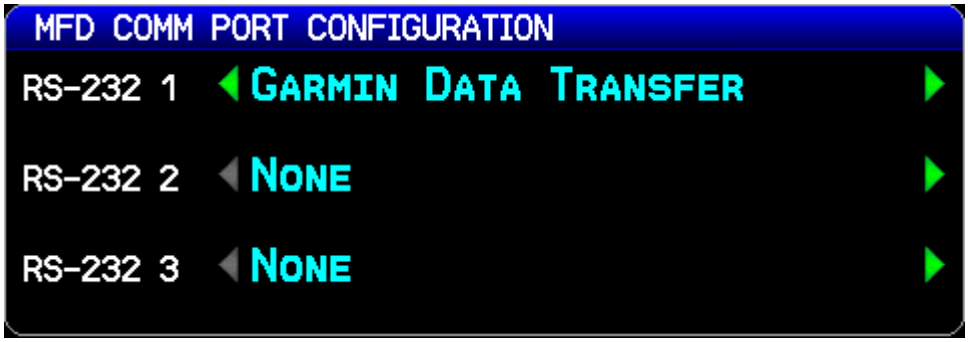
Alert Source – If more than one GDU 37X is installed, an Alert Source field will appear on the SOUND Configuration page. The Alert Source field allows the user to select which GDU will generate the alert sounds. The Alert Source options are: PFD1, PFD2, MFD, or Auto (which will use whichever unit is present, in the order PFD1, MFD, PFD2).

7.4.7 COMM Configuration Page

The COMM Configuration Page allows setting the parameters for the communication ports.

1. In configuration mode, use the FMS Joystick to select the COMM Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



A small green dot will appear next to the name of each RS-232 port when it is receiving valid data.

The RS-232 comm port configuration options for the COMM Configuration Page are listed/described as follows:

Garmin Data Transfer - The proprietary format used to exchange data with a PC.

NMEA Out - Supports the output of standard NMEA 0183 version 3.01 data at a baud rate of 4800.

Aviation In - The proprietary format used for input to the G3X (baud rate of 9600) from an FAA certified Garmin panel mount unit. Allows the G3X to display a Go To or route selected on the panel mount unit, which eliminates the need to enter the destination on both units.

Aviation In/NMEA & VHF Out - Receives aviation data and transmits out both NMEA data, at 9600 baud, and VHF frequency tuning information to a Garmin Nav/Comm radio.

TIS In - Receives TIS data from a Garmin Mode S transponder.

TIS In/NMEA & VHF Out - Receives TIS data and transmits out both NMEA data, at 9600 baud, and VHF frequency tuning information to a Garmin Nav/Comm radio.

SL30 Nav/Comm - RS-232 format. Outputs frequency tuning and course selection data to an SL30, and receives VOR/ILS signals to be displayed on the PFD.

7.5 Garmin Database Updates

The GDU 37X MFD database updates can be obtained by visiting the 'flyGarmin' website (www.fly.garmin.com). The 'flyGarmin' website requires the unit's System ID to update databases, this allows the databases to be encrypted with the unit's unique System ID when copied to the SD Card. The System ID is displayed on the System Setup Menu in normal mode, or on the Main Page in configuration mode.

Since these databases are stored internally in each GDU, each GDU will need to be updated separately. The SD card may be removed from the applicable GDU after installing the database(s). After the databases have been updated, check that the appropriate databases are initialized and displayed on the splash screen during power-up.

7.5.1 Updating Garmin Databases

Equipment required to perform the update is as follows:

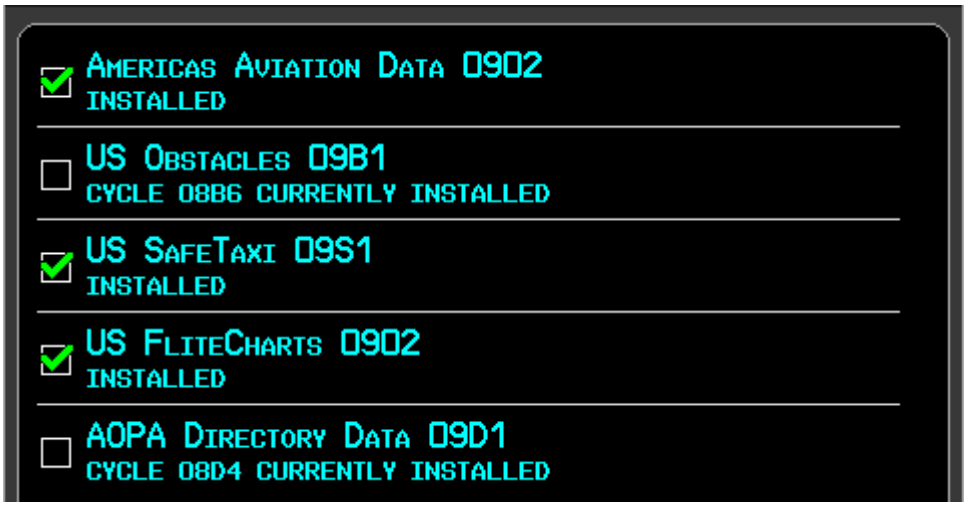
- Windows-compatible PC computer (Windows 2000 or XP recommended)
- SanDisk SD Card Reader, P/Ns SDDR-93 or SDDR-99 or equivalent card reader
- Updated database obtained from the flyGarmin website
- SD Card, 2 GB recommended (Garmin recommends SanDisk® or Toshiba brand)

After the data has been copied to the SD card, perform the following steps:

1. Insert the SD card in the card slot of the GDU 37X to be updated.

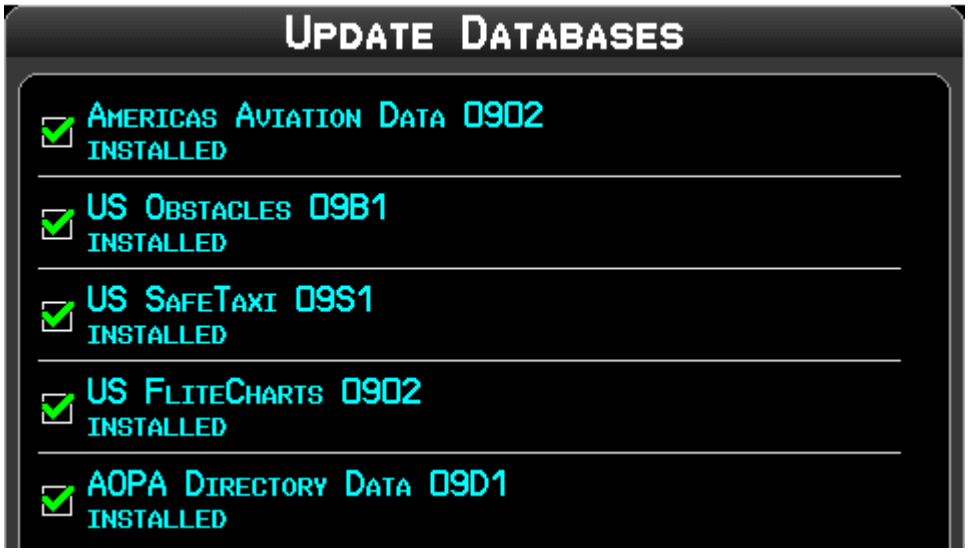
2. Turn on the GDU 37X to be updated.

3. Upon turn-on, a screen appears which lists the databases on the SD card. A green checkbox indicates that the database already installed on the G3X is up to date, an empty checkbox indicates that the database on the SD card is more current and should be installed.



4. The database(s) can be updated by either highlighting UPDATE ALL and pressing the ENT key; or by using the FMS Joystick to highlight a single database and pressing the ENT Key.

5. When the update process is complete, the screen updates the database status



6. Once the database(s) have been updated, the SD card can be removed from the unit.

7. The unit must be restarted by pressing the Restart softkey.

8. Repeat steps 1-7 for each installed GDU 37X.

7.5.2 Available Databases

Jeppesen® Aviation Data (NavData™)

The Jeppesen database contains the general aviation data (NavData) used by pilots (Airports, VORs, NDBs, SUAs, etc.) and is updated on a 28-day cycle.

Terrain

The terrain database contains the elevation data which represents the topography of the earth. This database is updated on an irregular basis.

Basemap

The basemap contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date.

Obstacle

The obstacle basemap contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not

all obstacles are necessarily charted and therefore may not be contained in the obstacle database. This database is updated on a 56-day cycle.

SafeTaxi

The SafeTaxi database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle, and has no expiration date.

FliteCharts

The FliteCharts database contains terminal procedure charts for the United States only. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer be user-accessible.

AOPA Airport Directory

The AOPA Airport Directory provides data on airports and heliports throughout the U.S. and offers detailed information for over 5,300 U. S. airports, along with the names and phone numbers of thousands of FBOs. Look up taxi services, plan an overnight, and choose fuel stops; plus find ground transportation, lodging, restaurants, local attractions, and more. This database is updated on a quarterly cycle, and has no expiration date.

7.6 XM Activation Instructions (GDU 375 only)

Follow the below instructions to activate the XM receiver in the GDU 375.

Before XM Satellite Weather can be used, the service must be activated by calling XM at 1.800.985.9200. Service is activated by providing XM Satellite Radio with a Radio ID. XM Satellite Radio uses the Radio ID to send an activation signal that allows the G3X MFD to display weather data an/or entertainment programming. XM service should activate in 45 to 60 minutes.

1. The Radio ID can be displayed by accessing the XM Audio Page, and then pressing the INFO Softkey. Record the Radio ID for reference during XM Activation.

2. Make sure that the aircraft's XM antenna has an unobstructed view of the southern sky. It is highly recommended that the aircraft be outside of and away from the hangar.

3. Hook up the aircraft to external power if available. The complete activation process may take 45-60 minutes or more, depending on the demand on the XM activation system.

4. Power on the avionics and allow the G3X to power up. Do not power cycle the units during the activation process.

5. Go to the XM Info Page. During the activation process the unit may display several different activation levels, this is normal and should be ignored. When the service class (Aviator Lite, Aviator, or Aviator Pro) and all of the weather products for the class that you subscribed to are displayed, the activation is complete. Wait 30 seconds to allow the GDU 375 to store the activation before removing power.

8. Post-Installation Checkout and Calibration Procedures

The checkout procedures in this section are recommended to be performed after installing the G3X. The calibration procedures are required to be performed after installing the G3X. It is assumed that the person performing these checks is familiar with the aircraft, has a working knowledge of typical avionics systems, and has experience using the test equipment defined in this section.

The calibration procedures in this section are performed in the configuration mode. To enter configuration mode, hold down the left-hand softkey while powering on the GDU 37X. In a two-display or three-display system hold down the left-hand softkey on the PFD while powering on the unit.

All three status boxes on the GSU Page (config mode) must indicate a positive state (green check marks) before performing any calibration procedures. The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have clear view of the sky or a GPS repeater to produce positive status indications.

The CONFIG GSU Page must be "unlocked" by pressing the softkeys 2, 3, 4 in order (Figure 8-1) to select a calibration procedure.

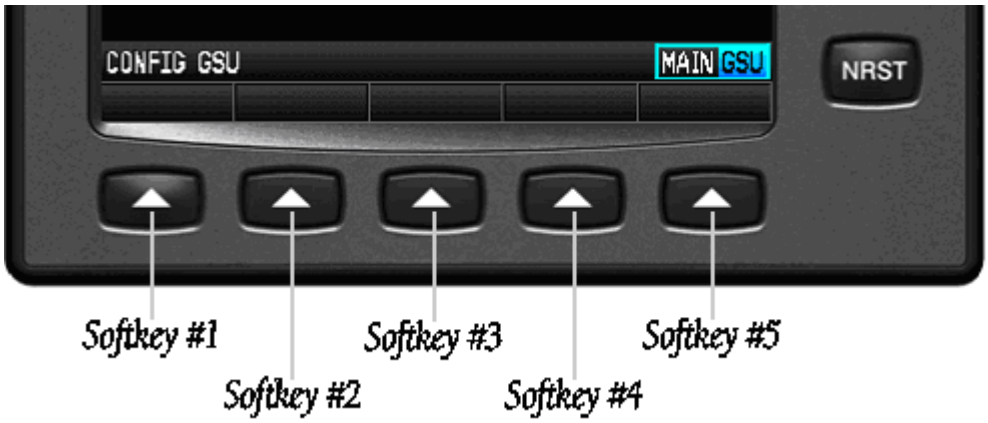


Figure 8-1 – Softkey Positions

NOTE

All procedures in this section require that the GPS receiver is receiving sufficient satellite signal to compute a present position. This requires outdoor line-of-site to GPS satellite signals or a GPS indoor repeater

NOTE

As these procedures involve engine run-up and moving the aircraft, it is recommended that the installer read this entire section before beginning the checkout procedure.

NOTE

Unless otherwise noted, all procedures apply to both one-display and two-display systems.

CAUTION

Be sure to check all aircraft control movements before flight is attempted to ensure that the wiring harness does not touch any moving part.

8.1 Recommended Test Equipment

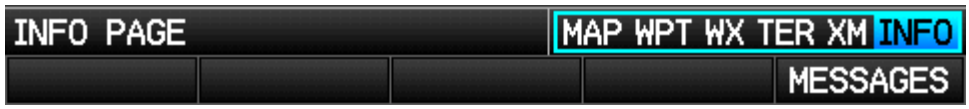
The following test equipment is recommended to conduct and complete all post installation checkout procedures in this section: (All test equipment should have current calibration records)

- Pitot/static ramp tester
- Digital Multi-Meter (DMM)
- Ground power unit capable of supplying 14/28 Vdc power to the aircraft systems and avionics
- Outdoor line-of-site to GPS satellite signals or GPS indoor repeater
- Digital Level or equivalent

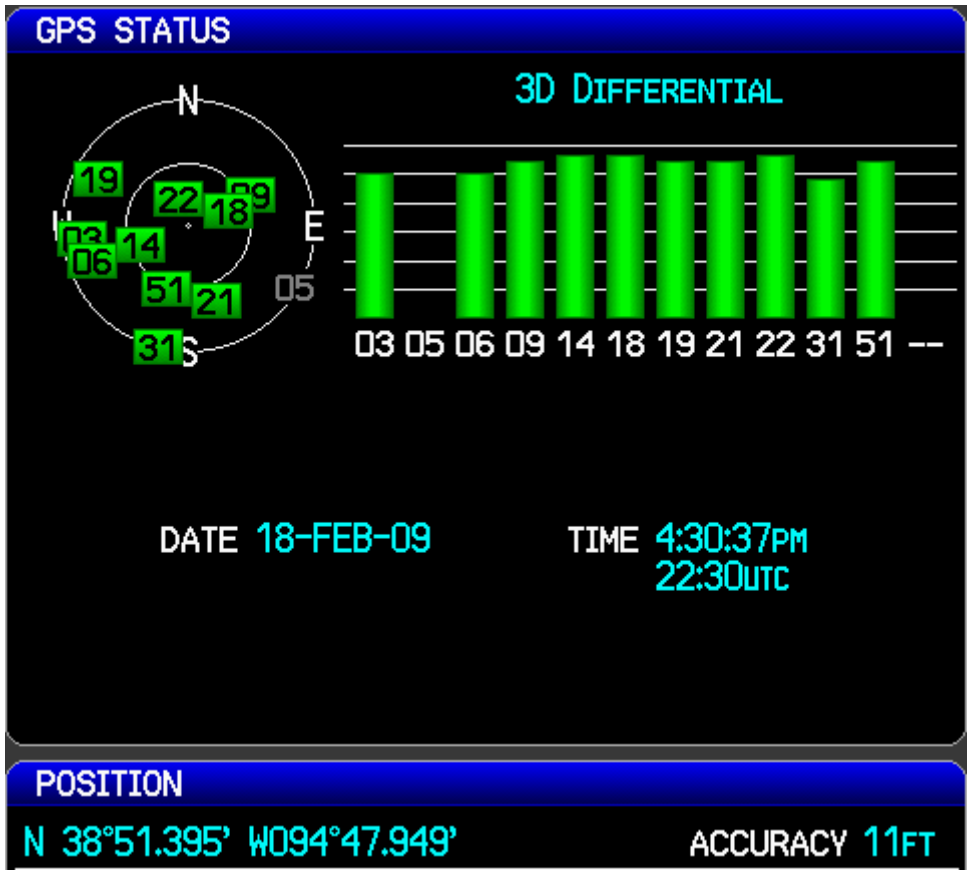
8.2 GDU 37X Test Procedure

Test the GPS Receiver:

1. Power on unit and use the FMS Joystick to select the Info Page.



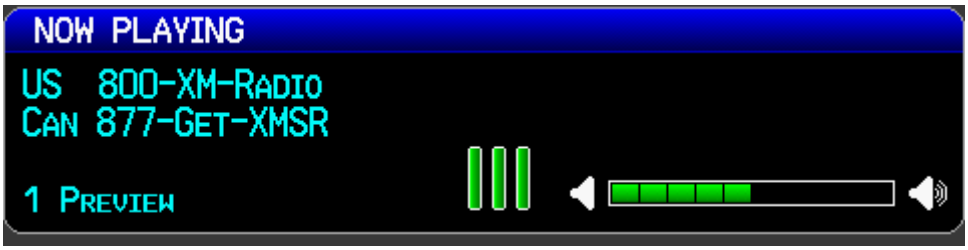
2. Verify that the GPS receiver is functional and able to calculate its present position.



Test the XM Receiver (if applicable):

1. Power on unit and use the FMS Joystick to select the XM Page.

2. Verify that the XM receiver is functioning correctly as indicated by the green signal strength bars. See Section 8.6 for XM Activation Instructions if needed.



8.3 GSU 73/GMU 44 Post-Installation Calibration Procedures

After mechanical and electrical installation of the GSU 73 AHRS and GMU 44 magnetometer have been completed, prior to operation, a set of post-installation calibration procedures must be carried out.

Table 8-1 describes the necessary calibration procedures:

Table 8-1. Post-Installation Calibration Procedure Summary

Calibration Procedure	Procedure Name	Procedure Description	Installations Requiring Procedure
A	AHRS Orientation	Validate GSU 73 Orientation	Procedure A is required for all installations
B	Pitch/Roll Offset Compensation	Level Aircraft	Procedure B is required for all installations
C	Magnetometer Calibration	Compass Rose Taxi Maneuver	Procedure C is required for all installations
D	Heading Offset Compensation	Compass Rose Alignment with Magnetic North	Installations in which GMU 44 alignment is not within 0.5° of aircraft longitudinal axis
E	Engine Run-Up Vibration Test	Validate vibration characteristics of installation	Procedure E is required for all installations
F	Magnetometer Interference Test	Validate no magnetic interference with GMU 44	Procedure F is required for initial installation verification. This test should also be repeated to verify all subsequent electrical changes associated with devices within 10.0 feet of the GMU 44 magnetometer. Such changes include, but are not limited to, wiring, shielding or grounding changes to any light, strobe, beacon or other electrical device located in the same wing as a GMU 44 unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU 44. Such changes include, but are not limited to, addition, removal or modification of ferrous or electrically conductive materials located in the same wing as a GMU 44 unit. Garmin recommends this test be performed at least once every 12 months by all aircraft manufacturers on a minimum of one production aircraft for every airframe type or model equipped with the G3X system.

For each Calibration Procedure, Table 8-2 lists the LRU's that require valid calibration data.

Table 8-2. Data Validity Requirements for AHRS Calibration Procedures

AHRS Calibration Procedure	Valid Status Required
Pitch/Roll Offset	GPS or Air Data
Magnetic Calibration	GPS or Magnetometer
Heading Offset	GPS or Air Data. Magnetometer always required.
Engine Run-Up	GPS or Air Data
Magnetometer Interference Test	GPS or Air Data. Magnetometer always required.
Mounting Orientation Identification	None

Table 8-3 lists the type of valid calibration data required to be output by each LRU for the Calibration Procedures listed in Table 8-2.

Table 8-3. Configuration Mode GSU Page Status Boxes

Status Box	Valid Status
GPS	3D or 3D Differential GPS solution available
Air Data	True Airspeed (TAS) available. NOTE: A valid outside air temperature (OAT) measurement is required for TAS to be valid.
Magnetometer	Measurement of local 3D magnetic field available

The GSU Page status boxes referred to in Table 8-3 are shown in the following figure.

If removal and replacement of a GMU 44 unit is required after post-installation calibration has been completed, the GMU 44 mounting rack must not be moved. If the mounting screws that secure the GSU 73 unit or the GMU 44 mounting rack are loosened for any reason, a new post-installation calibration procedure, A, B, C and E (plus D if required initially) must be carried out before the aircraft can be returned to service.

Any GMU 44 removal and replacement requires repeating the magnetometer calibration, and if applicable, the heading offset compensation.

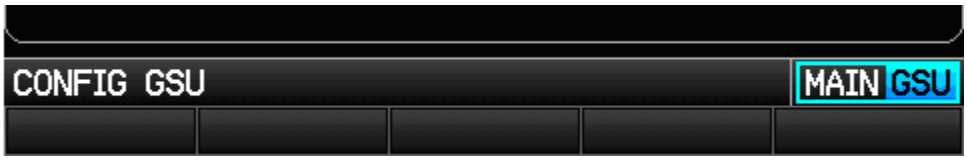
The addition, removal or modification of components that are ferrous, or otherwise magnetic, within 10.0 feet of the GMU 44 magnetometer location after the magnetometer interference test or magnetometer calibration procedure were completed requires a repeat of both procedures.

Furthermore, electrical changes to the installation that affect components within 10.0 feet of the GMU 44 magnetometer after the magnetometer calibration and magnetometer interference procedures were completed will require a repeat of the magnetometer interference test. If new magnetic interference is detected, it must be resolved and then the magnetometer calibration procedure must be repeated. Wiring or grounding changes associated with a device located in the same wing as the GMU 44 is a good example of such a change.

8.3.1 Calibration Procedure A: AHRS ORIENTATION

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X.

2. Use the FMS Joystick to select the GSU Page.

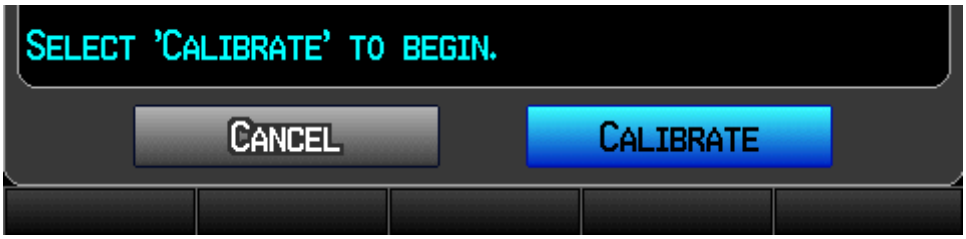


3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order.

4. Ensure that all the required status boxes are checked (Tables 8-2 and 8-3). The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have clear view of the sky or a GPS repeater to produce positive status indications.

5. Use the FMS Joystick to select AHRS ORIENTATION (if not already selected).

6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.
7. Determine the direction the connectors of the GSU 73 are facing per the on-screen instructions.
8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.

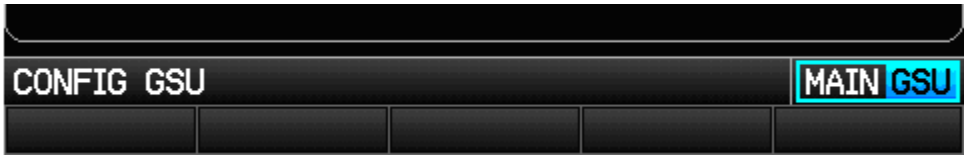


9. Use the FMS Joystick to select the direction of the GSU 73 connectors per the on-screen instructions, select OK and press the ENT Key to continue.

10. After a few minutes the calibration will finish and a Done button will appear at the bottom of the display, ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.

8.3.2 Calibration Procedure B: Pitch/Roll Offset Compensation by Aircraft Leveling

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).
2. Use the FMS Joystick to select the GSU Page (if needed).

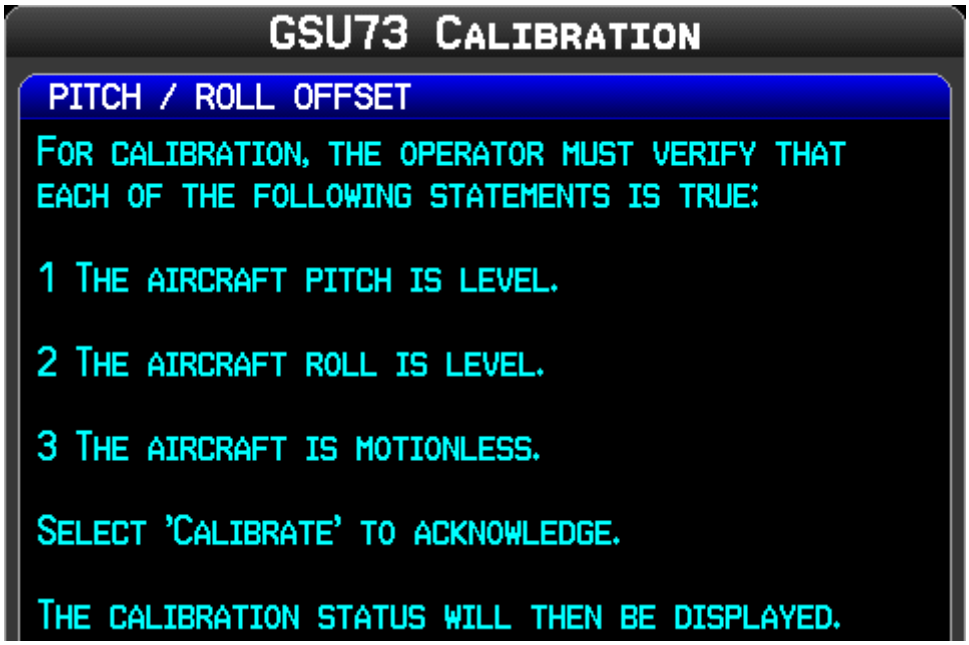


3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).
4. Ensure that all the required status boxes are checked (Tables 8-2 and 8-3). The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have clear view of the sky or a GPS repeater to produce positive status indications.

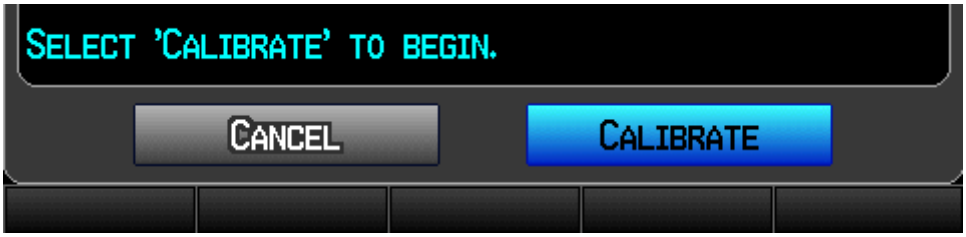
5. Use the FMS Joystick to select PITCH/ROLL OFFSET.

6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.

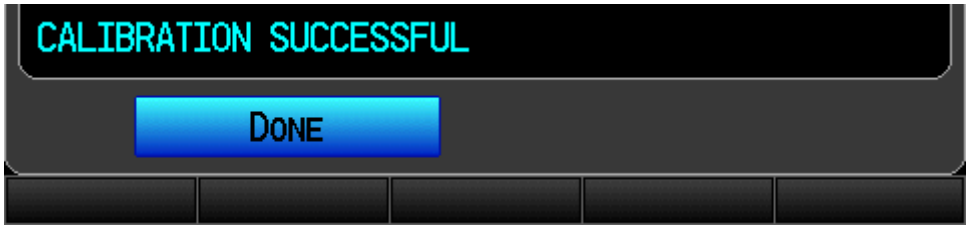
7. Ensure that the aircraft has been properly leveled per the on-screen instructions.



8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. After a few minutes the calibration will finish and a Done button will appear at the bottom of the display, ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.



8.3.3 Calibration Procedure C: Magnetometer Calibration

NOTE

Calibration Procedure B must be successfully completed prior to Calibration Procedure C.

NOTE

Calibration Procedure C must be carried out at a location that is determined to be free of magnetic disturbances, such as a compass rose. Attempting to carry out this maneuver on a typical ramp area will not yield a successful calibration. The accuracy of the AHRS cannot be guaranteed if this calibration is not performed at a magnetically clean location. A method for evaluating the magnetic disturbances at a candidate site is described in Section 8.3.7.

Taxi the aircraft to a site that has been determined to be free of magnetic disturbances. Ensure that there are no nearby magnetic materials on or near the perimeter of the site. If unavoidable, maneuver the aircraft to keep the magnetometer from passing within twenty feet (6.1 meters) of such objects. Additionally ensure that vehicles or other aircraft are an adequate distance [forty feet (12.2 meters)] away from the aircraft under test.

At the site, align the aircraft to a heading of magnetic north (±5°). It is best to offset the aircraft position to the left (west) of the North/South axis to allow turning clockwise around the site as indicated in Figure 8-2.

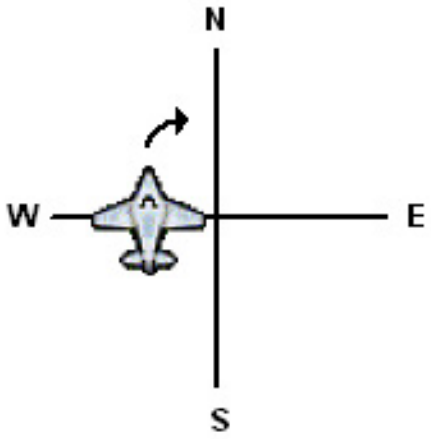
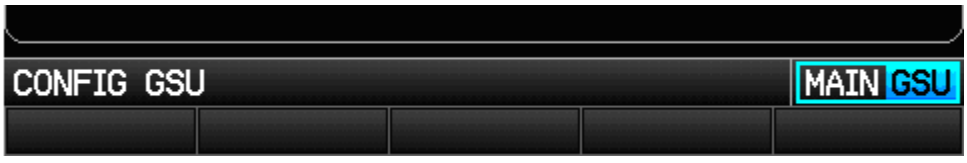


Figure 8-2 – Aircraft Alignment

With the aircraft stationary, initiate the GSU 73 AHRS magnetometer calibration procedure as follows:

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).

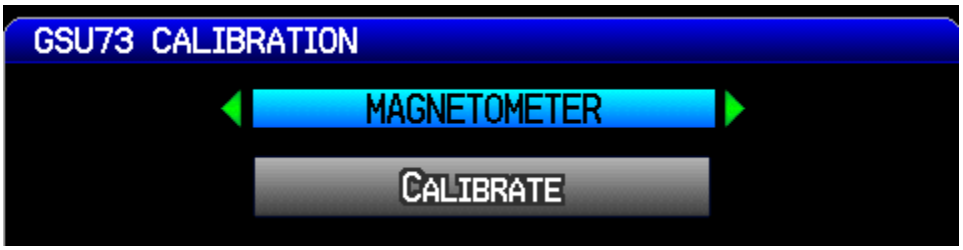
2. Use the FMS Joystick to select the GSU Page (if needed).



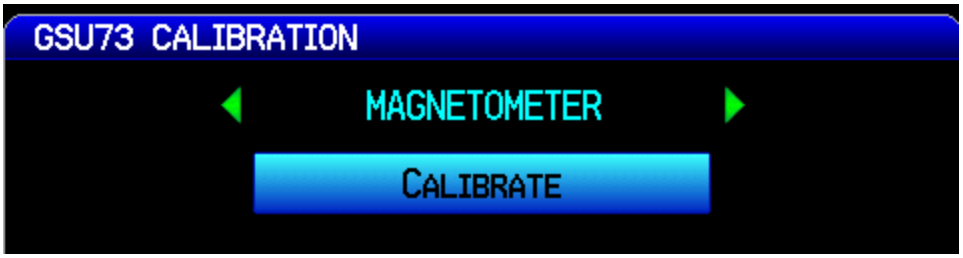
3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).

4. Ensure that all the required status boxes are checked (Tables 8-2 and 8-3). The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have clear view of the sky or a GPS repeater to produce positive status indications.

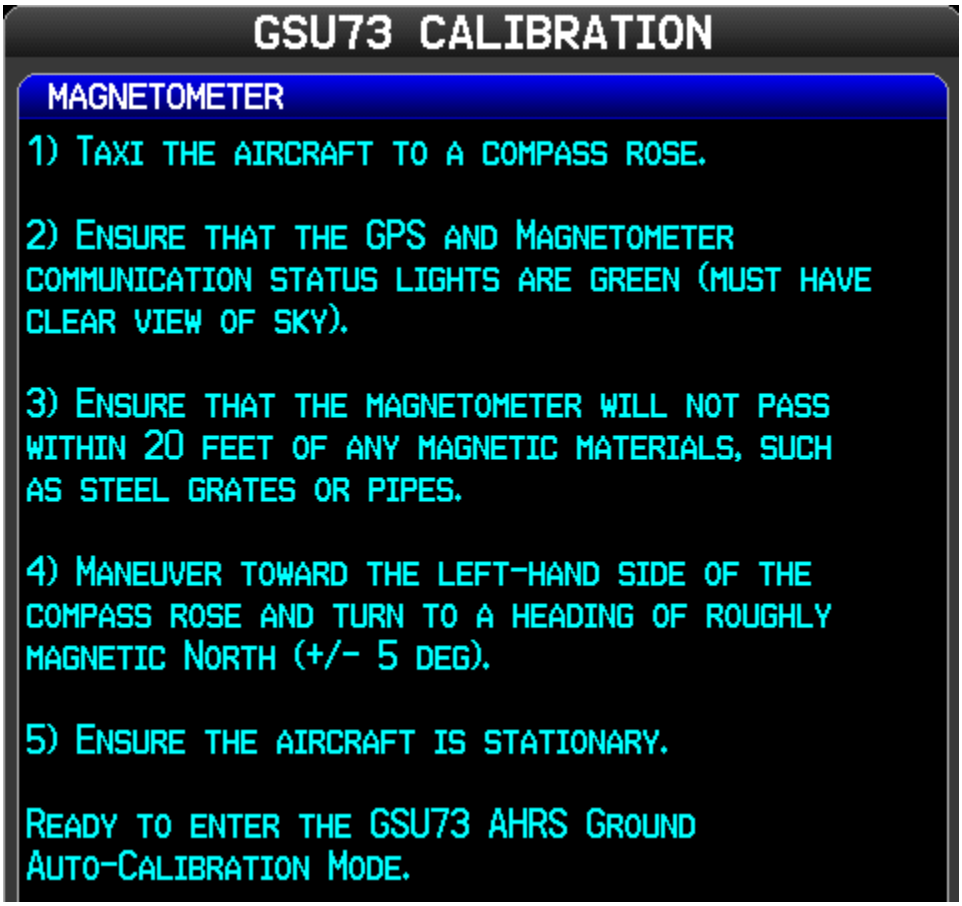
5. On the GSU Status Page, use the FMS Joystick to select MAGNETOMER.



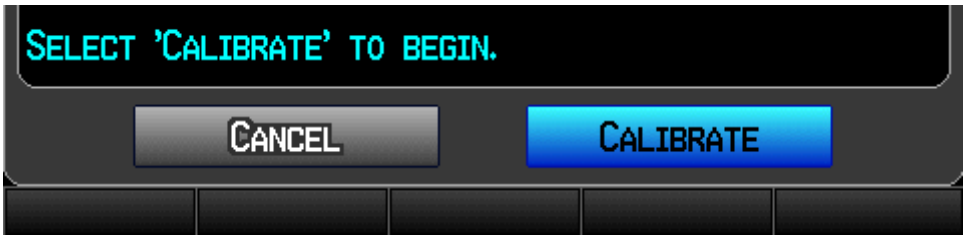
6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.



7. Ensure that the aircraft has been properly positioned per the on-screen instructions.



8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. The PFD advises the operator when to turn the aircraft, when to stop, and when to turn again.
10. Upon instruction to turn, taxi the aircraft in a right turn. After approximately 30° of turn from the last heading the PFD instructs the operator to stop the aircraft.

NOTE

Due to the difficulties in executing smooth, accurate turns the PFD may incorrectly interpret a station and instruct to "HOLD POSITION" prior to full completion of a 30° turn. If this scenario is encountered, it is best for the operator to ignore the "HOLD POSITION" command and instead use outside references to complete the approximate 30° of turn. Instead of using the PFD instruction to turn as a real-time indication of when to turn, simply judge the 30° (±5°) turn increments of the aircraft by using the compass rose radials. Dwelling at these 30° increments for the time recommended by the PFD should result in successful calibration.

11. The PFD guides the operator to dwell at multiple headings around a complete circle.

NOTE

Due to high winds or excessive airframe vibration, the operator may encounter a condition where the PFD restarts the 18-second countdown without full completion of the previous countdown. If this is encountered more than once for a given station, the operator should begin turning to the next station (approximately 30°). A minimum of 2 successful stations per quadrant is required, where a successful station is a full 18-second countdown followed by instruction to move. Ensure that if stations are skipped, a minimum of 2 stations per quadrant are completed. Thus, it may sometimes be required to dwell at a station after a countdown restart. A maximum of 30 stations is allowed for the entire calibration procedure. If too many countdown restarts are encountered, the calibration will fail with the message, "TOO MANY STATIONS."

12. When the calibration is finished, a Done button will appear at the bottom of the display, ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.

8.3.4 Calibration Procedure D: Heading Offset Compensation

NOTE

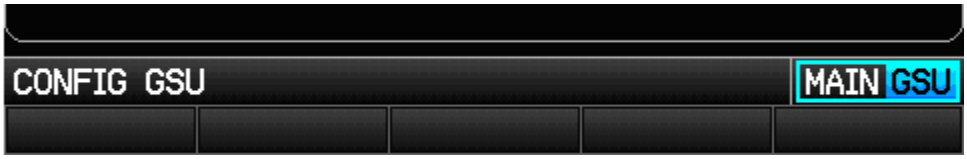
Calibration Procedures B and C must have been successfully completed before Calibration Procedure D can be performed.

This procedure is optional, and generally not recommended as it is difficult to orient the entire aircraft with an absolute accuracy of less than a few degrees. This procedure is required only when the GMU 44 Magnetometer has not been installed facing forward and parallel to within 0.5º of the aircraft longitudinal axis. For calibration accuracy, maneuver the aircraft with assistance from outside the cockpit to precisely align the aircraft to cardinal compass heading reference lines on the compass rose.

In order to accomplish the necessary degree of accuracy in heading alignment, it is generally required that the aircraft be physically towed by hand. Towing tugs should not be used as they distort the magnetic field in their vicinity.

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).

2. Use the FMS Joystick to select the GSU Page (if needed).



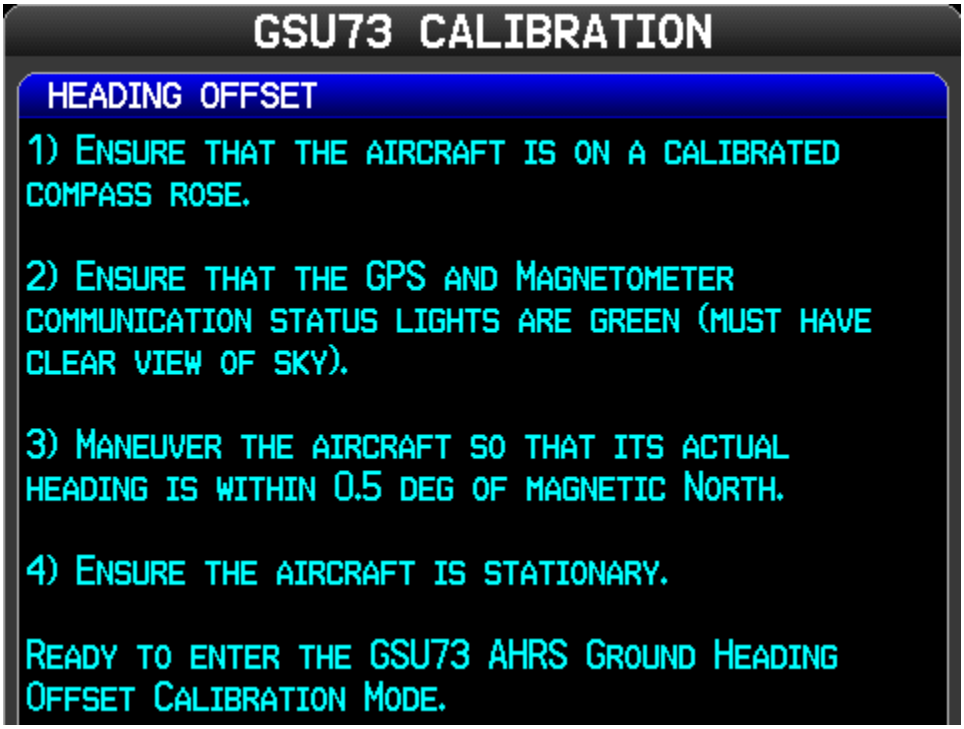
3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).

4. On the GSU Status Page, use the FMS Joystick to select HEADING OFFSET.

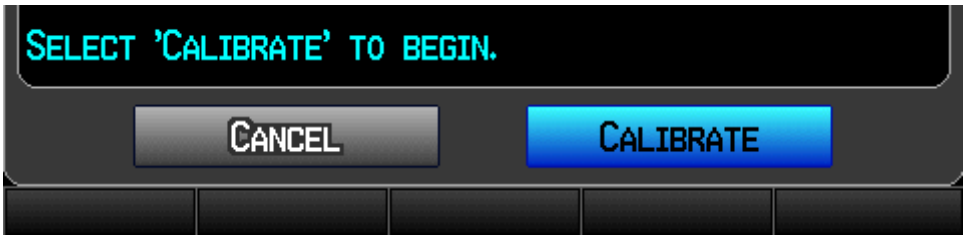
5. Ensure that all the required status boxes are checked (Tables 8-2 and 8-3). The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have a clear view of the sky or a GPS repeater to produce positive status indications.

6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.

7. Ensure that the aircraft has been properly positioned per the on-screen instructions.



8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. The PFD display advises the operator when to turn the aircraft to a cardinal heading, when to stop, and when to turn to another heading. During the procedure, the operator turns to magnetic headings of 360, 090, 180, and 270 degrees, within a tolerance of ±0.25°. Maneuver the aircraft with the longitudinal axis aligned with the desired heading line of the compass rose.
10. Repeat the preceding steps 3, 4, and 5 until a Calibration OK message is displayed.

11. After the complete calibration is finished, a Done button will appear at the bottom of the display, ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.

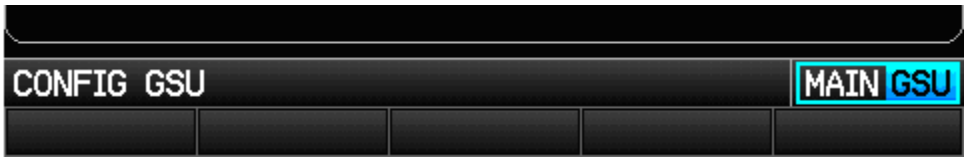
8.3.5 Calibration Procedure E: Engine Run-Up Vibration Test

NOTE

Calibration Procedure E is required for all installations to validate the vibration characteristics of the installation. Calibration Procedures B through D are not required prior to this procedure.

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).

2. Use the FMS Joystick to select the GSU Page (if needed).



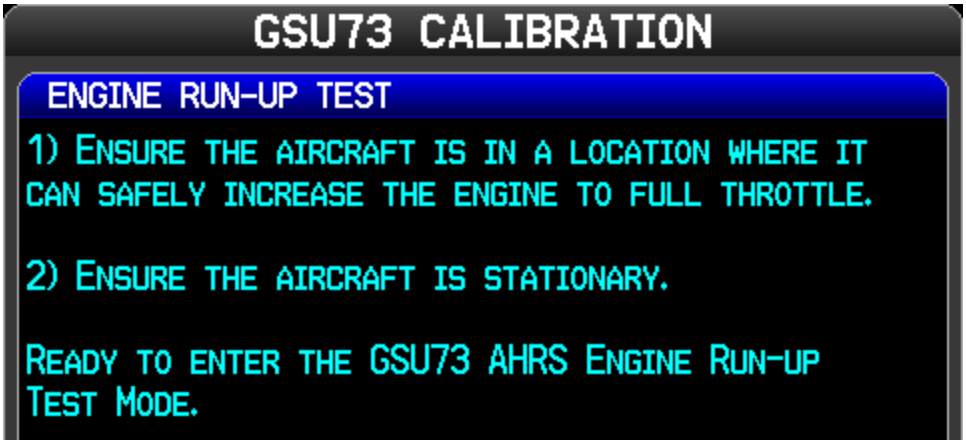
3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).

4. Ensure that all the required status boxes are checked (Tables 8-2 and 8-3). The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have clear view of the sky or a GPS repeater to produce positive status indications.

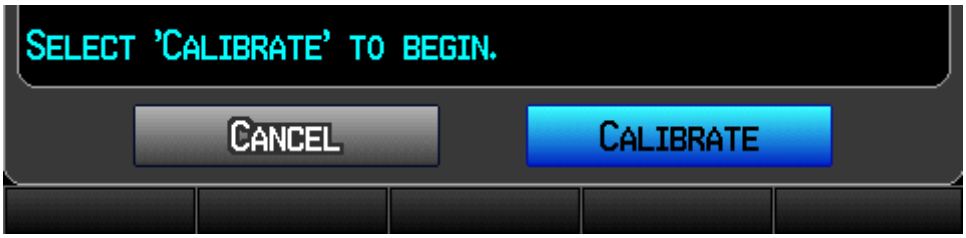
5. Use the FMS Joystick to select ENGINE RUN-UP TEST.

6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.

7. Ensure that the aircraft has been properly positioned per the on-screen instructions.



8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. The PFD display instructs the operator to gradually increase power from idle to full throttle and back to idle over the course of a couple of minutes.

NOTE

If failures are indicated, the engine run-up test may be repeated up to three times. If the test does not pass after three attempts, the installation should be considered unreliable until the source of the vibration problem is identified and remedied. If the engine run-up test fails repeatedly, record the values that are reported to be out of range for future reference.

The following are potential causes for failure of the engine run-up test:

a) Excessive flexibility of GSU 73 and/or GMU 44 mechanical mounting with respect to airframe (See Section 2.6 entitled “Aircraft Mounting Requirements for GSU 73/GMU 44”).

b) Vibrational motion of GSU 73 and/or GMU 44 caused by neighboring equipment and/or supports.

c) Mounting of GSU 73 at a location that is subject to severe vibrations (example; close to an engine mount.)

d) Mounting screws and other hardware for GSU 73 and/or GMU 44 not firmly attached.

e) Absence of mounting supports recommended by the aircraft manufacturer.

f) GSU 73 connector not firmly attached to unit.

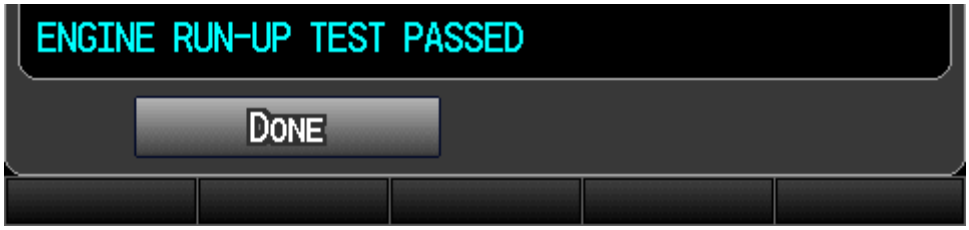
g) Cabling leading to GSU 73 or GMU 44 not firmly secured to supporting structure.

h) An engine/propeller combination that is significantly out of balance.

NOTE

In some aircraft, attempting the engine run-up test on a day with very strong and/or gusty winds may cause the test to occasionally fail. However, windy conditions should not be taken as evidence that the test would pass in calm conditions; an actual pass is required before the installation can be considered adequate.

10. After a few minutes the calibration will finish and a Done button will appear at the bottom of the display, ensure that a ENGINE RUN-UP TEST PASSED message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.



8.3.6 Calibration Procedure F: Magnetometer Interference Test

NOTE

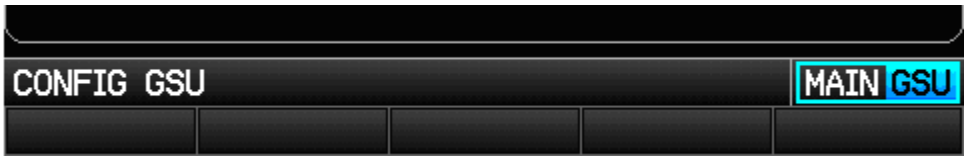
Calibration Procedure F is required for initial installation verification. This test should also be repeated to verify all subsequent electrical changes associated with devices within 10.0 feet of the GMU 44 magnetometer. Such changes include, but are not limited to, wiring, shielding or grounding changes to any light, strobe, beacon or other electrical device located in the same wing as a GMU 44 unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU 44. Such changes include, but are not limited to, addition, removal or modification of ferrous or electrically conductive materials located in the same wing as a GMU 44 unit. This procedure validates that no electronic device is interfering with the operation of the GMU 44 magnetometer which directly impacts the determination of attitude and heading by the GSU 73 AHRS. Calibration Procedures A through E are not required prior to this execution of this procedure.

NOTE

Garmin recommends this test be performed at least once every 12 months by all aircraft manufacturers on a minimum of one production aircraft for every airframe type or model equipped with the G3X system.

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).

2. Use the FMS Joystick to select the GSU Page (if needed).



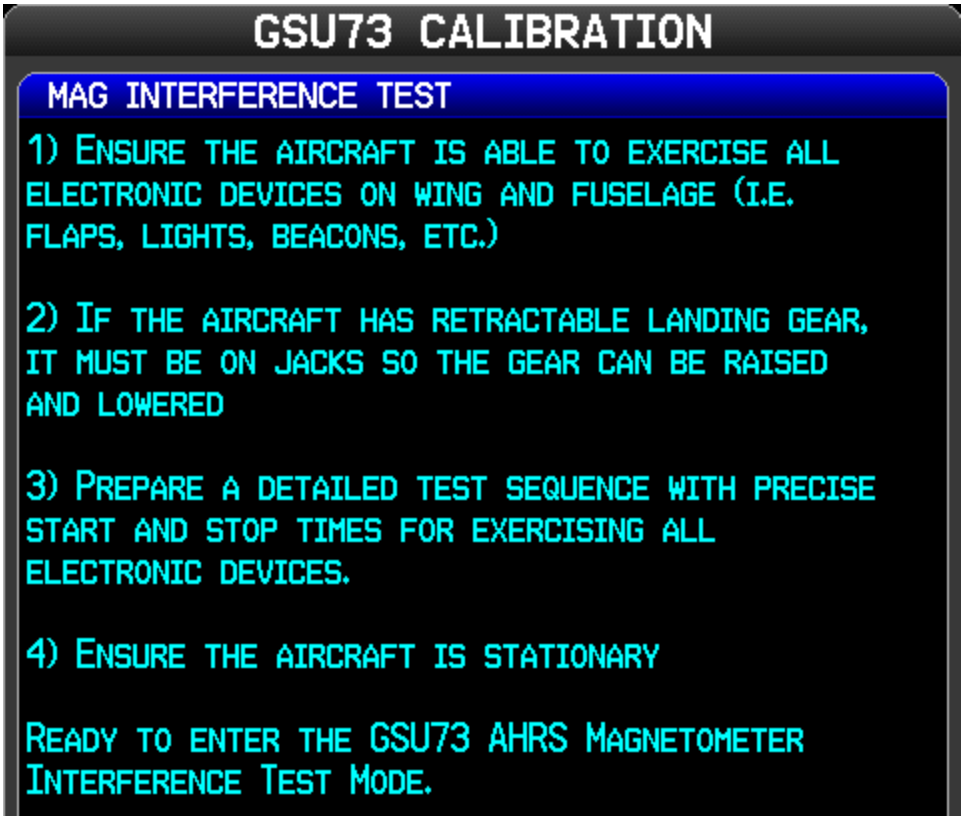
3. Unlock GSU Page by pressing softkeys 2, 3, 4 in order (if needed).

4. Ensure that all the required status boxes are checked (Tables 8-2 and 8-3). The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have clear view of the sky or a GPS repeater to produce positive status indications.

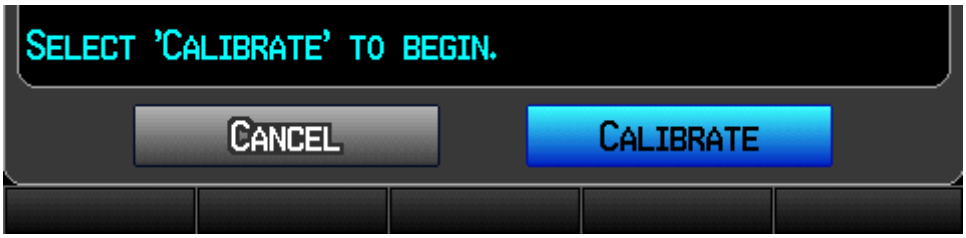
5. Use the FMS Joystick to select MAGNETOMETER INTERFERENCE TEST.

6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.

7. Ensure that the aircraft has been properly prepared per the on-screen instructions. See Table 8-2 for a sample test sequence.



8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. The operator should carry out the actions called for in the prepared test sequence.

NOTE

It is important that all actions are carried out in the order and at the precise elapsed time as specified in the prepared test sequence.

10. After the calibration is finished, a Done button will appear at the bottom of the display, ensure that a MAG INTERFERENCE TEST PASSED message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.

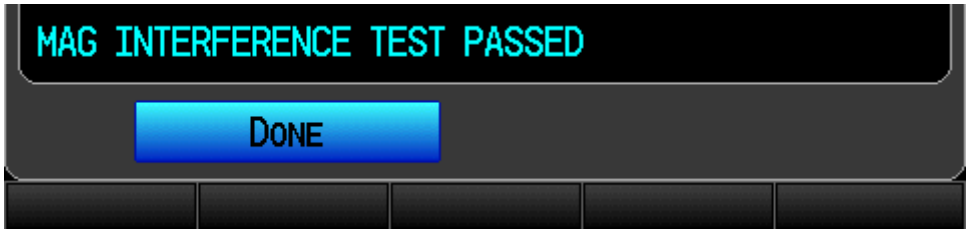


Table 8-4. Magnetometer Interference Test Sequence Example

Elapsed Time Since Start of Test (min:secs)	Action
0:00	Test begins
0:10	Aileron full right
0:20	Aileron full left
0:30	Aileron level
0:40	Flaps down
0:50	Flaps up
1:00	Landing gear up
1:20	Landing gear down
1:40	Speed brake up
1:50	Speed brake down
2:00	Navigation lights on
2:10	Navigation lights off
2:20	Landing lights on
2:30	Landing lights off
2:40	Taxi lights on
2:50	Taxi lights off
3:00	Landing + Taxi lights on
3:10	Landing + Taxi lights off
3:20	Strobes on
3:30	Strobes off
3:40	Recognition lights on
3:50	Recognition lights off
4:00	Turn on all wing-tip lights simultaneously (typically will include navigation lights, recognition lights and strobe)
4:10	Turn off all wing-tip lights simultaneously
4:20	Beacon on
4:30	Beacon off
4:40	Pitot heat on
4:50	Pitot heat off
5:00	End of test

If the test fails, the installation should be considered unreliable until the source of magnetic interference is identified and remedied. The magnetometer interference test must be repeated until passed. When the magnetometer interference test fails, record the three magnetometer maximum deviation values and their corresponding timestamps. A maximum deviation value greater than 5.0 milliGauss in either the X or Y axes, or greater than 8.0 milligauss in the Z axis indicates a problem that must be resolved. Compare the corresponding timestamps with the prepared test sequence to identify which action produced the problem. Contact Garmin for assistance in resolving the problem.

NOTE

Two common reasons for a failed magnetometer interference test are:

1) New equipment is installed in close proximity to the GMU 44 magnetometer.

2) An existing or new electronic device has become grounded through the aircraft structure instead of via the proper ground wire in a twisted shielded pair.

8.3.7 Site Evaluation of Magnetic Disturbances for Magnetometer Calibration Procedure

As mentioned in Section 8.3.3, the Magnetometer Calibration Procedure (Calibration Procedure C) must be carried out at a site that is determined to be free of magnetic disturbances.

NOTE

Typically, a compass rose is an acceptable location to perform the magnetometer calibration procedure. However, because not all compass roses are well maintained, even an existing compass rose should be regularly evaluated using the method described here to determine if it is free of magnetic disturbances. If evaluation of an existing compass rose indicates that magnetic disturbances are present, then an alternative location must be found to perform the Magnetometer Calibration Procedure.

A G3X-equipped airplane can be used to evaluate a candidate site for magnetic disturbances and determine whether it is a suitable location to perform the magnetometer calibration procedure. The magnetometer calibration procedure itself contains the logic to simultaneously survey the location for magnetic cleanliness while it is computing the magnetometer calibration parameters.

The G3X-equipped airplane installation used to evaluate the site must have already completed the pitch/roll offset compensation procedure (Procedure B). However, prior completion of the Magnetometer Calibration Procedure (Procedure C) is not required.

In order to evaluate a candidate site, the Magnetometer Calibration Procedure must be performed twice: once turning clockwise around the site, and once turning counter-clockwise. Both times, the procedure should be conducted as described in Section 8.3.3 of this document, with the exception of the direction of turns around the site.

NOTE

Although Section 8.3.3 indicates that the Magnetometer Calibration Procedure should be performed by making a series of clockwise turns around the site, the procedure can also be performed by making counter-clockwise turns for the purpose of evaluating the site for magnetic disturbances.

If, upon completion of the Magnetometer Calibration Procedure in both the clockwise and counter-clockwise directions, the PFD displays the “CALIBRATION SUCCESSFUL / SITE IS CLEAN” message, then the candidate site is sufficiently free of magnetic disturbances and is acceptable for performing the Magnetometer Calibration Procedure. It is important to perform the procedure in both the clockwise and counter-clockwise directions to ensure that the magnetometer sweeps over a large enough area at the candidate site.

If, upon completion of the Magnetometer Calibration Procedure in either of the two directions, the PFD displays either the “MAG FIELD AT SITE NOT UNIFORM”, or “MAG FIELD AT SITE DIFFERS FROM IGRF MODEL” message, then the site contains magnetic disturbances that are too large.

NOTE

The Magnetometer Calibration Procedure must consistently report "CALIBRATION SUCCESSFUL / SITE IS CLEAN" in both the clockwise and counter-clockwise directions for the site to be considered acceptable. More than one failure out of ten attempts in a given direction would be sufficient reason to conclude the site is not acceptable.

A site that is used repeatedly to perform the Magnetometer Calibration Procedure should be re-evaluated every 12 months, and after any significant construction or placement of magnetic objects (above or below ground) within 50 meters of the location.

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9 Troubleshooting

In this section the term 'Red-X' refers to a red "X" that appears on different areas of the display to indicate the failure of that particular function.

Refer to the G3X Pilot's Guide (190-01054-00) for a complete listing of System Status Messages.

For additional assistance, contact your G3X Dealer, then for further help (if needed), contact Garmin Aviation Product Support at US Toll Free Number 1-888-606-5482, or US 1-913-397-8200.

NOTE

The information in this section is for troubleshooting use only and does not supersede any approved Maintenance or Installation Manual instructions.

9.1 GDU 37X

9.1.1 SD Card Slot

A stuck or sticking SD card issue can sometimes be caused by the card thickness variability (especially if there is more than one label on the card). This is usually caused by the card sticking in the overlay opening, not by the card sticking to the socket inside the unit. Try another card (without a label if possible) to confirm the problem before returning. If the second card sticks, the SD socket board inside the unit may be misaligned with the overlay and the GDU 37X will require repair. If the thickness of the card was the cause, see if more than one label was on the card. If the labels weren't the cause, determine what brand of SD card was being used (Garmin recommends using SanDisk® or Toshiba brand cards).

9.1.2 Crosstalk Error (Dual or Three Screen Systems)

Crosstalk Error messages occur if there is a mismatch in GDU 37X software versions. If this occurs, the GDU's will not communicate with each other, and a software mismatch message will be reported on the INFO page (press the MSG softkey). Ensure both displays are running the same software version to clear the issue.

9.2 GMU 44

Figure 9-1 – Heading Failure Indication (Full-Screen PFD)

9.2.1 Red-X Failures

If a Red-X (steady or intermittent) is displayed on the heading (Figure 9-1), check the following while the aircraft is on the ground:

1. When taxiing without reliable GPS information, heading performance is susceptible to the presence of magnetic anomalies (metal buildings, underground steel culverts, steel grates in the ramp, rebar). Localized sources of interference on the ground may consistently cause a Red-X to be displayed on the heading in the same spot while taxiing, this is not caused by a failure of the GMU 44 or its calibration.
2. When the aircraft is taxiing on the ground with a yaw rate of less than 1.5 degrees/second (i.e., taxiing essentially in a straight line) GPS track information is used to update heading information. This logic is applied regardless of magnetic anomaly detection.
3. The GDU may display Red-X on the heading if the GSU 73 does not have GPS information, or if it senses a magnetic anomaly.
4. While a magnetic anomaly is detected and the aircraft is determined to be stationary, the value of the heading output is frozen. When either the aircraft is determined to be no longer stationary or the magnetic anomaly ceases, heading will be unfrozen and determined as useable. In this context, the aircraft is considered to be stationary when its yaw rate is less than 1.0 degrees/second and all other angular rate and acceleration values are sufficiently small. (moving or shaking the wings or tail for example can cause a Red-X to be displayed).
5. Check to see if any new equipment has been installed on the aircraft, and reference Table 3-5 for minimum distances for installed equipment from the GMU 44 to prevent interference.

If the GMU 44 heading is not present on the GDU 37X, there may be a problem with the RS-232 line between the GSU 73 and GMU 44. Troubleshoot any possible wiring/connector issues before replacing either unit.

9.3 GSU 73

GSU 73 ground operation is heavily dependent on GPS data inputs. Be sure to correct any GPS performance problems (i.e. interference caused by some types of cell phones or anything that transmits in the area) before troubleshooting the GSU 73/GMU 44. For GPS data to be considered usable, the receiver must be tracking at least 4 satellites and have a 3D GPS Solution.

GSU 73 AHRS operation needs at least two of the three inputs from; the GPS receiver, the GMU 44, and the Air data (also part of the GSU 73) for proper operation. See Table 9-1 below for the attitude and heading outputs the GSU 73 can provide based on the available data inputs.

Table 9-1 – GSU 73 AHRS Operating Mode Table

GSU 73 Mode	GSU 73 Input			GSU 73 Output		
	GPS data	GMU44 data	Air data data	Heading	Pitch	Roll
Primary	Good	Good	Doesn't matter	Valid	Valid	Valid
Reversion No GPS	Bad	Good	Good	Valid	Valid	Valid
Reversion No Mag	Good	Bad or anomaly	Good	Invalid	Valid	Valid
Reversion No Mag, No Air	Good	Bad or anomaly	Bad	Invalid	Valid	Valid
Coast On Gyros	Bad	Either or Both Bad		Invalid	Invalid	Invalid
Output Unreliable	Bad	Either or Both Bad		Invalid	Invalid	Invalid

For complaints concerning GSU 73 realignments performed while in the air (i.e. the pilot feels that the realignment is taking too long or does not seem to be reinitializing), Table 9-2 shows the pitch and roll limits that the pilot must maintain for the GSU 73 to realign itself. If the pilot was performing maneuvers outside these limits, the GSU 73 may not properly reinitialize.

Table 9-2 – GSU 73 AHRS Pitch/Bank Limitations for Cold Start While Airborne

	Sensor Inputs Available and Valid					
Mode of Operation Entered Following Initialization	**All Inertials**	**GPS**	**Mag**	**Air Data (internal)**	**Bank Limit in Degrees**	**Pitch Limit in Degrees**
Primary	YES	YES	YES	NA	± 20.0	± 5.0
Reversion No GPS	YES	NO	YES	YES	± 10.0	± 5.0
Reversion No Mag	YES	YES	NO	YES	± 10.0	± 5.0
Reversion No Mag, No Air	YES	YES	NO	NO	± 10.0	± 5.0

9.3.1 Attitude/Heading Failure Troubleshooting

Prior to troubleshooting an Attitude Failure on-board the aircraft, gather information from the pilot by asking the following questions.

1. What specifically was the nature of the failure? Was it a Red-X of only heading, only pitch/roll, or both?

2. If there was a Red-X of pitch or roll information, did the PFD display the "AHRS Align: Keep Wings Level" message (which is indicative of an AHRS reset), or the "Attitude Fail" message (which is indicative of either AHRS invalidating its output, or a communication path failure)?

3. What exactly was the aircraft doing in the two minutes that preceded the failure (taxing on the ground, flying straight-and-level flight, turning, climbing, etc)? If the problem occurred on the ground, was it within 100 feet of a hanger using GPS repeaters?

4. How long did the failure last? Was it brief or sustained? Was it repetitive in nature? If it was repetitive, about how many times did it happen? Did it happen on more than one day?

5. Was the problem correlated with a specific maneuver or a specific geographic area?

6. Can the problem be repeated reliably?

7. Were any of the following message advisory alerts observed (must navigate to the INFO page and press the MSG softkey to see them) within an hour of the occurrence of the problem?

    - AHRS not receiving airspeed
    - AHRS not receiving any GPS information
    - AHRS magnetic-field model out of date
    - AHRS extended operation in no-GPS mode

8. Did the onset of the problem occur shortly after a software upload to one or more of the G3X LRU's, or shortly after a repeat of the magnetometer calibration procedure?

9. Was a cell phone on in the aircraft at the time?

10. Were there any GPS Alert messages or loss of position lock?

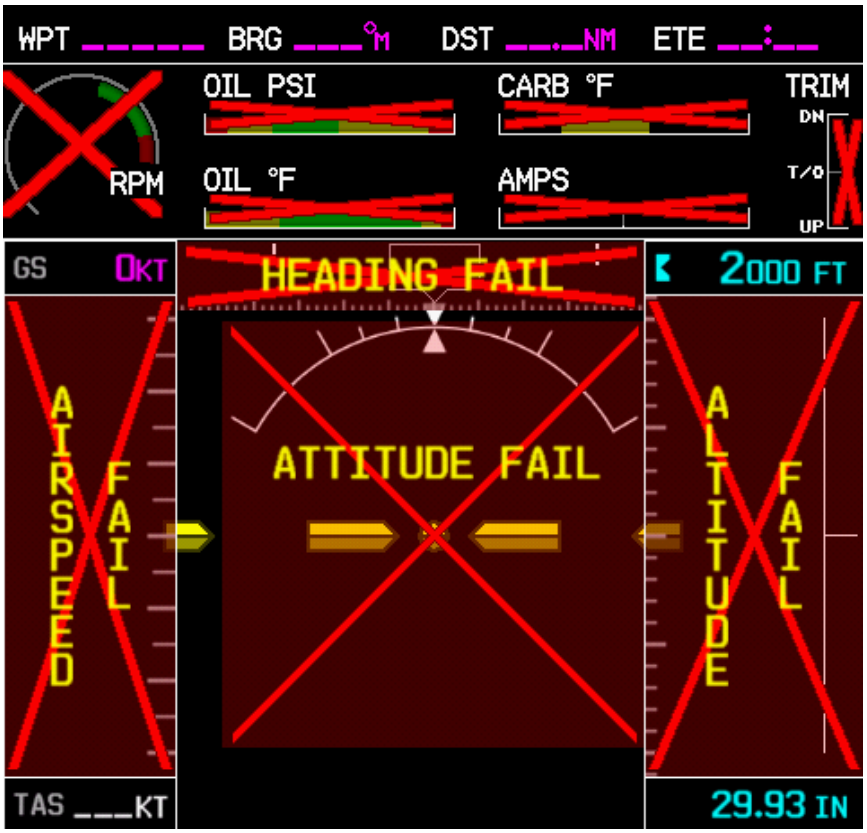

Figure 9-2 – Attitude, Air Data, and Engine/Airframe Failure Indication (Reversionary or Split-Screen PFD)

Figure 9-3 – Attitude Fail Indication (PFD)

Figure 9-4 – AHRS Align Message (PFD)

9.3.2 Heading/Pitch/Roll Troubleshooting

The GSU 73 may not be able to provide valid heading/pitch/roll data for the following reasons:

1. The GSU 73 external memory module in the harness (that stores the installation configuration parameters) is either not present or not wired properly. If this is the case, then the external installation configuration parameters will not be considered calibrated. If an "AHRS not Calibrated" message is displayed, the AHRS and/or Magnetometer calibration needs to be performed, or the GSU 73 configuration module is inoperative.

2. The external installation configuration parameters are not considered calibrated. These parameters are categorized into 2 sets: AHRS installation, and Magnetic installation. If either of these is not calibrated, the GSU 73 heading, pitch, and roll may all be flagged as invalid and an "AHRS not Calibrated" message is displayed. Calibrate the unit to the installation.

3. There is not sufficient or valid sensor information being provided to the GSU 73 for it to compute valid attitude information. Table 9-1 summarizes the inputs the GSU needs to provide Attitude and Heading information.

9.4 GSU 73 –Air Data Troubleshooting

Under normal operating conditions, the GSU 73 provides the following air data information:

- Total Air Temperature is measured
- Outside Air Temperature (OAT)
- Indicated Airspeed (IAS)
- True Airspeed (TAS)
- Barometric Altitude
- Density Altitude
- Pressure Altitude
- Static Pressure
- Differential Pressure

If the TAS and/or OAT indications are dashed out as shown in Figure 9-5:

1. Check the GTP 59 OAT probe wiring and connection for faults.
2. Check GSU 73 configuration module wiring for damage. Replace if any is found.
3. Replace the GTP 59 OAT probe.
4. If the problem persists, replace the GSU 73 with a known good unit

Figure 9-5 – No info for TAS & OAT

NOTE

TAS information can only be displayed at speeds greater than 20 Knots (i.e. TAS is invalid when the aircraft is sitting still).

If the Airspeed and/or Altitude is failed and shows a Red-X condition as shown in Figure 9-6:

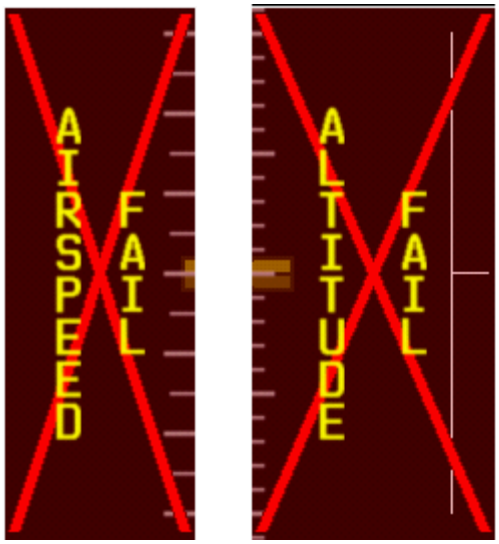

Figure 9-6 – Airspeed and Altitude Failure Indications

1. Inspect GSU73 pitot/static plumbing integrity

2. Inspect pitot/static ports and associated equipment

3. If the problem persists replace the GSU 73 with a known good unit

9.4.1 Troubleshooting GSU 73 Engine Indication Failures

See Figure 9-7 for example. The following may help to determine to cause of an Engine Indication failure.

1. Does cycling power restore operation?

2. Did the operator give it sufficient time to start and initialize?

3. Did the problem begin after a software or configuration load?

4. Did the problem happen on the ground or while airborne?

5. Is only the EGT Red-X'd? If so, the GSU 73 configuration module, configuration module wiring, thermocouple reference, or applicable thermocouple is defective. Check the wiring and replace the configuration module or applicable thermocouple.

6. Are there one or more temperatures that drop as the electrical load increases? If a temperature probe shorts (usually where the bayonet is crimped) a ground loop is created forcing the reference (low side) to increase which causes the temperature reading to decrease.

7. Does the EGT temperature slowly drift up and eventually flag? This is an indication of an (electrical) open in the temperature probe or wiring.

8. Is the air data information on the PFD intermittently Red-X'ing? If the GSU 73 +5VDC transducer power supply is shorted to ground, it will cause an intermittent air data Red-X issue to occur.

9. If the AMP indication Red-X'd, check the Alternator Shunt for correct resistance. Refer to the applicable aircraft manual.

10. If the Trim Indication is Red-X'd, check the Elevator Trim Pot Sensor and wiring.

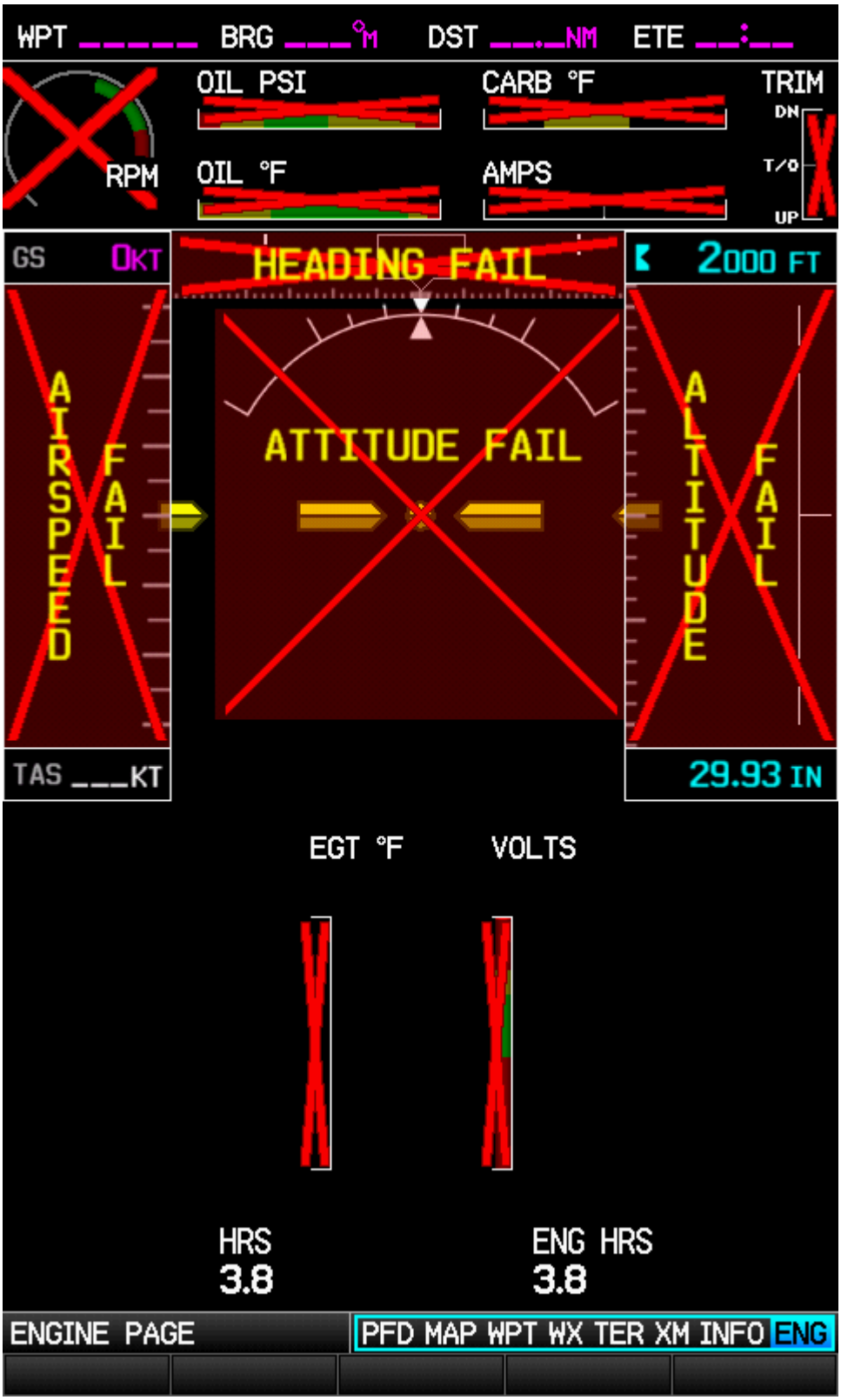

Figure 9-7 – Attitude, Heading, Air Data, and Engine/Airframe Failure (Reversionary or Split-Screen PFD)

9.5 Troubleshooting On-board the Aircraft

1. Review the airframe logbook to verify if any G3X or other avionics or electrical maintenance had been performed recently that may have contributed to the failure.

2. Check for loose wire terminals on the circuit breaker connections on the power wire(s) causing intermittent power connections. Also, check for intermittent circuit breakers.

3. Have ground power put on the aircraft.

4. Turn on the G3X and record the system software level on the GDU start up page.

5. After the system is initialized, note any Red-X's on the displays, ALERT messages and Red-X's on the GDU.

If the failure cannot be verified, proceed to the following physical inspection.

1. Turn off the G3X and remove the interior panels to gain access to the GSU 73. Inspect the physical installation of the GSU 73.

2. Check that the connectors are fully seated, and that the jack screw connectors are fully tightened on both sides of the GSU 73 connector.

3. Check for a loose wire harness that is able to move around during flight. This condition may cause the wire to pull on or vibrate the connector making intermittent connections.

4. Ensure that the GSU 73 is mounted securely. If any doubt exists, use a screwdriver to check the tightness of the four mounting screws.

5. Look in the vicinity of the GSU 73 for any heavy objects that may not be fastened tight to the structure that could induce GSU 73 vibration.

6. Look for evidence of water or fluid contamination in the area around the GSU 73.

7. Unplug the GSU 73 connector and check for bent pins.

8. Inspect the wire harness clamp on the rear of the connector to verify that it is not too tight and smashing/shorting the wires. If the wire clamp is installed upside down, it has sharp edges that can cut into the wires. Also verify the presence of protective wire wrap between the wires and the clamp.

If the condition is not resolved by following the preceding instructions, contact Garmin Product Support for additional assistance. A Garmin Field Service Engineer may ask the technician to download the fault logs to a PC (via the USB port on the GSU 73) and email the logs back to Garmin to help determine if the problem is in the GSU 73 or in the aircraft.

9.6 GSU Page

All three status boxes on the GSU Page (config mode) must indicate a positive state (green check marks) before performing any calibration procedures (Section 8). The GMU 44 and GSU 73 units must be communicating with the GDU 37X, and the GPS antenna must have clear view of the sky to produce positive status indications.

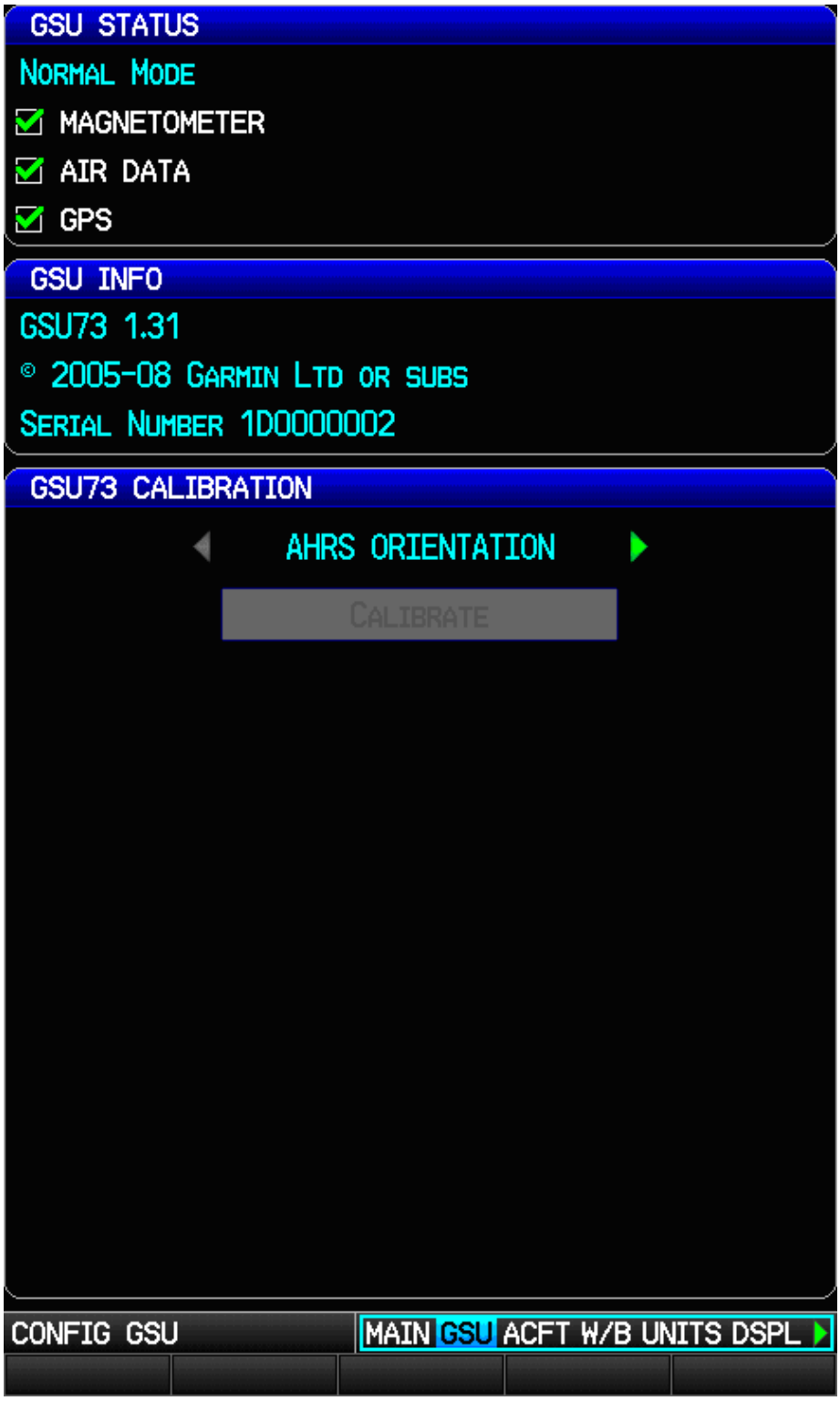

Figure 9-8 – CONFIG GSU Page

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10 Return to Service Information

These return to service procedures are intended to verify the serviceability of the appliance only. These tests alone do not verify or otherwise validate the airworthiness of the installation.

10.1 GDU 37X

10.1.1 Original GDU 37X is Reinstalled

No software or configuration loading is required if the original GDU 37X is reinstalled. Continue to Section 10.2.

10.1.2 Original GDU 37X(s) Installed in a Different Position

No software or configuration loading is required if the GDU 37X is installed in a different location. Continue to Section 10.2.

10.1.3 New GDU 37X(s) Installed

If a new GDU 37X is installed (new serial number), verify the correct software version on the MAIN page in configuration mode. Additionally verify that all installed displays have the same software version, as well as NavData, terrain, and obstacle databases. If the correct software version is not installed, update the displays to the current G3X system software available on the web. No configuration is required if the configuration module is still operational. Continue to Section 10.2.

10.1.4 New GDU 37X (PFD) Configuration Module Installed

Ensure that a new configuration module is obtained for the replacement installation. If a new configuration module is installed and no change is made to the PFD, the PFD will write the required configuration information to the configuration module. If the PFD and the configuration module are both replaced, the system will need to be configured (Section 7).

NOTE

Do not use a used GDU configuration module as a replacement. Data that may reside on the used configuration module may cause system configuration errors.

10.2 GSU 73

NOTE

A pitot/static check as outlined in 91.411 and Part 43 Appendix E must be completed if the pitot/static lines are broken.

10.2.1 Original GSU 73 is Reinstalled

No software or configuration loading is required if the original GSU 73 is reinstalled. Continue to Section 10.3.

10.2.2 New GSU 73 Installed

If a new GSU 73 is installed (new serial number), verify the correct software version on the MAIN page in configuration mode. If the correct software version is not installed, load the GSU 73 software contained in the G3X system software loaded to the displays. If the configuration module is operational, no software configuration is required. Continue to Section 10.3.

10.3 GMU 44

NOTE

If the GMU 44 is removed, the anti-rotation properties of the mounting screws must be restored. This may be done by replacing the screws with new Garmin P/N 211-60037-08. If original screws must be re-used, coat screw threads with Loctite 242 (blue) thread-locking compound, Garmin P/N 291-00023-02, or equivalent. Important: Mounting screws must be brass.

10.3.1 GMU 44 is Reinstalled

Any time a GMU 44 is reinstalled, a new magnetometer calibration is required (Section 8.3.3). Continue to Section 10.3.2

10.3.2 New GMU 44 Installed

If a new GMU 44 is installed (new serial number), a new magnetometer calibration (Section 8.3.3) and verification of the correct software version (Section 7.2) is required. If the correct software version is not installed, load the GMU 44 software contained in the G3X system software which is loaded to the displays (Section 7). Following a successful magnetometer calibration, and software verification the Return to Service Procedure is complete.

APPENDIX A G3X Pinouts

A.1 GDU 37X

A.1.1 P3701 Connector

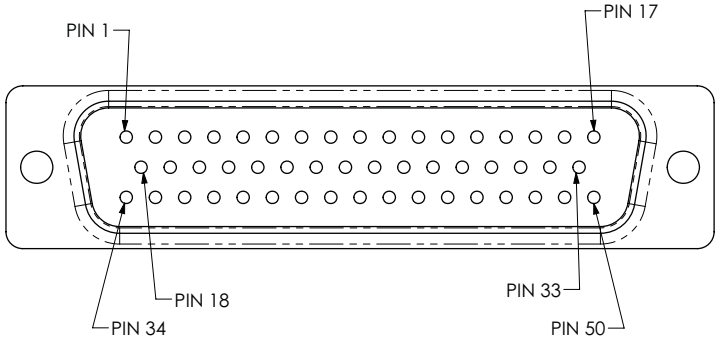


Figure A-1. View of J3701 Connector from Back of Unit

Pin	Pin Name	I/O
1	MONO AUDIO OUT HI	Out
2	STEREO AUDIO OUT LO	--
3	STEREO AUDIO OUT LEFT	Out
4	SPARE	--
5	SPARE	--
6	SPARE	--
7	SPARE	--
8	SPARE	--
9	CDU SYSTEM ID PROGRAM* 2	In
10	CDU SYSTEM ID PROGRAM* 1	In
11	RESERVED FOR FUTURE DEVELOPMENT, DO NOT USE	--
12	RESERVED FOR FUTURE DEVELOPMENT, DO NOT USE	--
13	RS-232 OUT 3	Out
14	RS-232 IN 2	In
15	POWER GROUND	--
16	POWER GROUND	--
17	CONFIG MODULE POWER OUT	Out
18	MONO AUDIO OUT LO	--
19	STEREO AUDIO OUT RIGHT	Out
20	STEREO AUDIO OUT LO	--
21	SPARE	--
22	SPARE	--
23	SPARE	--
24	SPARE	--
25	CDU SYSTEM ID PROGRAM* 3	In
26	28V LIGHTING BUS HI	In
27	SIGNAL GROUND	--
28	CAN BUS TERMINATION	--
29	RS-232 IN 3	In
30	RS-232 OUT 2	Out
31	AIRCRAFT POWER 2	In
32	AIRCRAFT POWER 1	In

* Indicates Active Low

Connector P3701, continued		
Pin	**Pin Name**	**I/O**
33	CONFIG MODULE CLOCK	I/O
34	SIGNAL GROUND	--
35	SIGNAL GROUND	--
36	SIGNAL GROUND	--
37	SIGNAL GROUND	--
38	SPARE	--
39	SPARE	--
40	SPARE	--
41	SPARE	--
42	CDU SYSTEM ID PROGRAM* 4	In
43	14V LIGHTING BUS HI	In
44	SIGNAL GROUND	--
45	CAN BUS LO	I/O
46	CAN BUS HI	I/O
47	RS-232 IN 1	In
48	RS-232 OUT 1	Out
49	CONFIG MODULE GROUND	--
50	CONFIG MODULE DATA	I/O

* Indicates Active Low

A.1.2 Aircraft Power

AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are "diode ORed" to provide aircraft power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P3701	32	In
AIRCRAFT POWER 2	P3701	31	In
POWER GROUND	P3701	15	--
POWER GROUND	P3701	16	--

A.1.3 Mode Selections

Configure the GDU 37X units per the following tables. A GDU 37X can be manually placed in reversionary mode by grounding Pin 25. Grounding pin 42 will place the GDU 37X in Demo mode, which is for in-store demonstration use only, never ground pin 42 in an aircraft installation.

PFD MODE 1, P3701 Pin 10	PFD MODE 2, P3701 Pin 9	GDU Mode
Open	Open	MFD
Ground	Open	PFD1
Open	Ground	PFD2
Ground	Ground	Do Not Use

PFD MODE 3 P3701 Pin 25	GDU Mode
Open	Auto Reversionary
Ground	Forced Reversionary

PFD MODE 4 P3701 Pin 42	GDU Mode
Open	Normal Operation
Ground	Demo Mode

A.1.4 Serial Data

A.1.4.1 RS-232

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of 0-5V when driving a standard RS-232 load.

Pin Name	Connector	Pin	I/O
RS-232 IN 1	P3701	47	In
RS-232 OUT 1	P3701	48	Out
RS-232 IN 2	P3701	14	In
RS-232 OUT 2	P3701	30	Out
RS-232 IN 3	P3701	29	In
RS-232 OUT 3	P3701	13	Out

A.1.4.2 CAN Bus

This data bus conforms to the BOSCH standard for Controller Area Network 2.0-B. This bus complies with ISO 11898. CAN BUS TERMINATION should be connected to CAN BUS LO for the GDU that is located at the end of the bus (farthest from the GSU 73).

Pin Name	Connector	Pin	I/O
CAN BUS HI	P3701	46	I/O
CAN BUS LO	P3701	45	I/O
CAN BUS TERMINATION	P3701	28	--

A.1.4.3 Configuration Module

In multiple GDU 37X installations, it is only necessary to connect a configuration module to PFD1.

Pin Name	Connector	Pin	I/O
CONFIG MODULE CLOCK	P3701	33	I/O
CONFIG MODULE DATA	P3701	50	I/O
CONFIG MODULE POWER OUT	P3701	17	Out
CONFIG MODULE GROUND	P3701	49	--

A.1.5 Lighting

The GDU 37X display and keys can be configured to track 28 VDC or 14 VDC lighting busses using these inputs.

Pin Name	Connector	Pin	I/O
14V LIGHTING BUS HI	P3701	43	In
28V LIGHTING BUS HI	P3701	26	In

A.1.6 Audio

A.1.6.1 Mono Audio

Pin Name	Connector	Pin	I/O
MONO AUDIO OUT HI	P3701	1	Out
MONO AUDIO OUT LO	P3701	18	--

A.1.6.2 Stereo Audio

Pin Name	Connector	Pin	I/O
STEREO AUDIO OUT LEFT	P3701	3	Out
STEREO AUDIO OUT LO	P3701	20	--
STEREO AUDIO OUT RIGHT	P3701	19	Out
STEREO AUDIO OUT LO	P3701	2	--

The left and right common pins (pins 2 and 20) may be tied together or only one may be used. It is not necessary to use both common pins.

A.2 GMU 44

A.2.1 P441 Connector

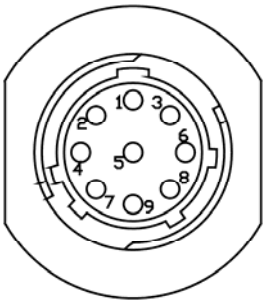


Figure A-2. View of J441 Connector Looking at Rear of Unit

Pin	Pin Name	I/O
1	SIGNAL GROUND	--
2	RS-485 OUT B	Out
3	SIGNAL GROUND	--
4	RS-485 OUT A	Out
5	SPARE	--
6	POWER GROUND	--
7	SPARE	--
8	RS-232 IN	In
9	+12 VDC POWER	In

A.2.2 Power Function

Power-input pins accept 14/28 VDC. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses.

Pin Name	Connector	Pin	I/O
+12 VDC POWER, GMU 44	P441	9	In
POWER GROUND, GMU 44	P441	6	--

A.2.3 Serial Data

A.2.3.1 RS-232

Pin Name	Connector	Pin	I/O
RS-232 IN	P441	8	In

A.2.3.2 RS-485

Pin Name	Connector	Pin	I/O
RS-485 OUT A	P441	4	Out
RS-485 OUT B	P441	2	Out

A.3 GSU 73

A.3.1 Connector Description

The GSU 73 has one 62-pin connector (J731) and one 78-pin connector (J732) located on the connector end of the unit, as shown below. J731 and J732 are clearly marked on the connector end plate.

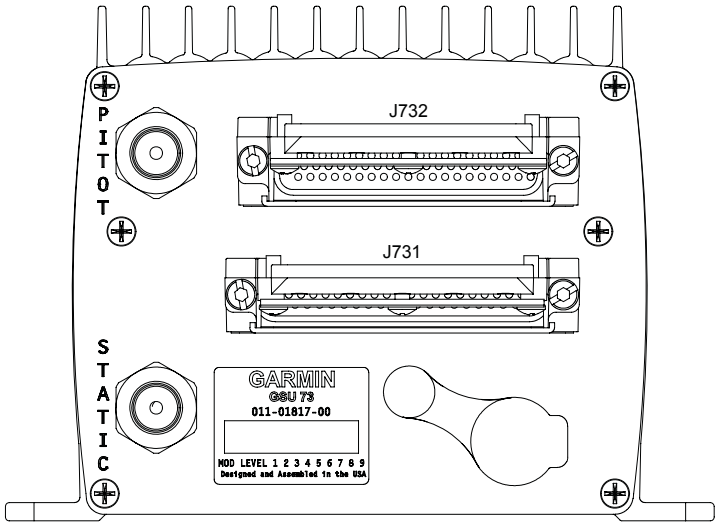


Figure A-3 Rear View of Connector End Plate

A.3.2 Pin List

A.3.2.1 P731 Connector

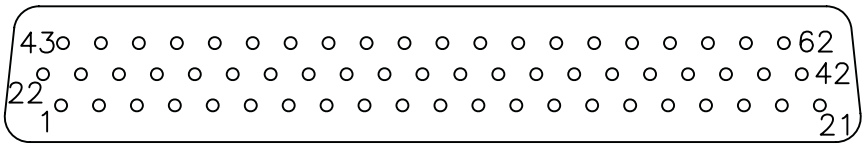


Figure A-4 Rear Connector J731 Viewed from Connector End of Unit

J731 pins are configured as shown in preceding figure. J731 pin assignments are given in the following table, additional tables group pin connections by function.

Pin	Pin Name	I/O
1	MAGNETOMETER RS-485 IN B	In
2	MAGNETOMETER RS-485 IN A	In
3	SIGNAL GROUND	--
4	GSU SYSTEM ID PROGRAM* 1	In
5	GSU SYSTEM ID PROGRAM* 2	In
6	RESERVED	--
7	CAN BUS HI	I/O
8	CAN BUS LO	I/O
9	DISCRETE IN* 1	In
10	DISCRETE IN* 2	In
11	DISCRETE IN* 3	In
12	DISCRETE IN* 4	In
13	DISCRETE OUT* 1	Out
14	DISCRETE OUT* 2	Out
15	MAGNETOMETER RS-232 OUT	Out

* Indicates Active Low

Connector P731, continued		
Pin	**Pin Name**	**I/O**
16	RS-232 IN 2	In
17	RS-232 OUT 2	Out
18	RS-232 IN 3	In
19	RS-232 OUT 3	Out
20	ARINC 429 OUT 1 A	Out
21	ARINC 429 OUT 1 B	Out
22	ARINC 429 OUT 2 A	Out
23	ARINC 429 OUT 2 B	Out
24	SIGNAL GROUND	--
25	ARINC 429 IN 1 A	In
26	ARINC 429 IN 1 B	In
27	ARINC 429 IN 2 A	In
28	ARINC 429 IN 2 B	In
29	CAN BUS TERMINATION	--
30	ARINC 429 IN 3 A	In
31	ARINC 429 IN 3 B	In
32	ARINC 429 IN 4 A	In
33	ARINC 429 IN 4 B	In
34	SIGNAL GROUND	--
35	SIGNAL GROUND	--
36	SIGNAL GROUND	--
37	SIGNAL GROUND	--
38	MAGNETOMETER POWER OUT	Out
39	MAGNETOMETER GROUND	--
40	SIGNAL GROUND	--
41	SPARE	--
42	SPARE	--
43	SIGNAL GROUND	--
44	SPARE	--
45	SPARE	--
46	SPARE	--
47	AIRCRAFT POWER 1	In
48	SPARE	--
49	AIRCRAFT POWER 2	In
50	SPARE	--
51	SPARE	--
52	SPARE	--
53	SIGNAL GROUND	--
54	SIGNAL GROUND	--
55	SPARE	--
56	SPARE	--
57	SPARE	--
58	SIGNAL GROUND	--
59	POWER GROUND	--
60	SIGNAL GROUND	--
61	POWER GROUND	--
62	SPARE	--

A.3.2.2 P732 Connector

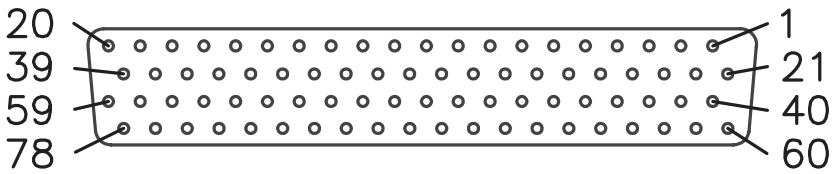


Figure A-5 Rear Connector J732 Viewed from Connector End of Unit

Pin	Pin Name	I/O
1	ANALOG IN 2 LO	In
2	ANALOG IN 3 HI	In
3	ANALOG IN 8 LO	In
4	ANALOG IN 9 LO	In
5	ANALOG IN 14 LO	In
6	ANALOG IN 17 LO	In
7	ANALOG IN 24 LO	In
8	ANALOG IN 23 LO	In
9	THERMOCOUPLE REF IN LO	In
10	THERMOCOUPLE REF IN HI	In
11	ANALOG IN 20 LO	In
12	ANALOG IN 19 LO	In
13	ANALOG IN 6 LO	In
14	ANALOG IN 12 LO	In
15	OAT PROBE IN HI	In
16	OAT PROBE POWER OUT	Out
17	FREQUENCY COUNTER IN* 1	In
18	SIGNAL GROUND	--
19	FREQUENCY COUNTER IN* 2	In
20	CONFIG MODULE CLOCK	Out
21	ANALOG IN 2 HI	In
22	ANALOG IN 3 LO	In
23	ANALOG IN 8 HI	In
24	ANALOG IN 9 HI	In
25	ANALOG IN 14 HI	In
26	ANALOG IN 16 HI	In
27	ANALOG IN 24 HI	In
28	ANALOG IN 23 HI	In
29	ANALOG IN 11 LO	In
30	ANALOG IN 11 HI	In
31	ANALOG IN 20 HI	In
32	ANALOG IN 19 HI	In
33	ANALOG IN 6 HI	In
34	ANALOG IN 12 HI	In
35	OAT PROBE IN LO	In
36	FREQUENCY COUNTER IN* 3	In
37	SIGNAL GROUND	--
38	FREQUENCY COUNTER IN* 4	In
39	CONFIG MODULE DATA	I/O

* Indicates Active Low

Connector P732, continued		
Pin	**Pin Name**	**I/O**
40	ANALOG IN 4 LO	In
41	ANALOG IN 1 LO	In
42	ANALOG IN 10 LO	In
43	ANALOG IN 7 LO	In
44	ANALOG IN 15 LO	In
45	ANALOG IN 16 LO	In
46	ANALOG IN 25 LO	In
47	ANALOG IN 22 HI	In
48	ANALOG/CURRENT MONITOR IN 2 HI	In
49	ANALOG IN 21 LO	In
50	ANALOG/CURRENT MONITOR IN 1 LO	In
51	ANALOG IN 18 LO	In
52	ANALOG IN 13 LO	In
53	ANALOG IN 5 LO	In
54	SPARE	--
55	+12 VDC TRANSDUCER POWER OUT	Out
56	TRANSDUCER POWER OUT LO (GROUND)	--
57	TRANSDUCER POWER OUT LO (GROUND)	--
58	+10 VDC TRANSDUCER POWER OUT	Out
59	CONFIG MODULE POWER OUT	Out
60	ANALOG IN 4 HI	In
61	ANALOG IN 1 HI	In
62	ANALOG IN 10 HI	In
63	ANALOG IN 7 HI	In
64	ANALOG IN 15 HI	In
65	ANALOG IN 17 HI	In
66	ANALOG IN 25 HI	In
67	ANALOG IN 22 LO	In
68	ANALOG/CURRENT MONITOR IN 2 LO	In
69	ANALOG IN 21 HI	In
70	ANALOG/CURRENT MONITOR IN 1 HI	In
71	ANALOG IN 18 HI	In
72	ANALOG IN 13 HI	In
73	ANALOG IN 5 HI	In
74	TRANSDUCER POWER OUT LO (GROUND)	--
75	+5 VDC TRANSDUCER POWER OUT	Out
76	RESERVED (FUEL SENSOR PULL-UP 2 (ANALOG IN 15))	--
77	RESERVED (FUEL SENSOR PULL-UP 1 (ANALOG IN 14))	--
78	CONFIG MODULE GROUND	--

* Indicates Active Low

A.3.3 Power I/O

A.3.3.1 Aircraft Power

The GSU 73 has four inputs for aircraft power bus inputs of 14/28Vdc.

Pin	Connector	Pin Name	I/O
47	P731	AIRCRAFT POWER 1	IN
49	P731	AIRCRAFT POWER 2	IN
59	P731	POWER GROUND	--
61	P731	POWER GROUND	--

A.3.3.2 Transducer Output Power

The GSU 73 supplies output power for engine/airframe sensors that may require supply voltage excitation. The GSU 73 outputs voltage levels of +5, +10, and +12 Vdc.

Pin	Connector	Pin Name	I/O
55	P732	+12VDC TRANSDUCER POWER OUT	OUT
56	P732	TRANSDUCER POWER OUT LO (GROUND)	--
58	P732	+10VDC TRANSDUCER POWER OUT	OUT
57	P732	TRANSDUCER POWER OUT LO (GROUND)	--
75	P732	+5VDC TRANSDUCER POWER OUT	OUT
74	P732	TRANSDUCER POWER OUT LO (GROUND)	--

A.3.3.3 Magnetometer Power

The GSU 73 outputs supply voltage to the GMU 44 via pins 38 & 39.

Pin	Connector	Pin Name	I/O
38	P731	MAGNETOMETER POWER OUT	OUT
39	P731	MAGNETOMETER GROUND	--

A.3.4 GSU System ID Program

Pins 4 & 5 must be left open (floating) for proper G3X configuration.

Pin	Connector	Pin Name	I/O
4	P731	GSU SYSTEM ID PROGRAM* 1	IN
5	P731	GSU SYSTEM ID PROGRAM* 2	IN

* Indicates Active Low

A.3.5 Serial Data Electrical Characteristics

A.3.5.1 ARINC 429 Input/Output

The ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to 5 standard ARINC 429 receivers.

Pin	Connector	Pin Name	I/O
20	P731	ARINC 429 OUT 1A	OUT
21	P731	ARINC 429 OUT 1B	OUT
22	P731	ARINC 429 OUT 2A	OUT
23	P731	ARINC 429 OUT 2B	OUT
25	P731	ARINC 429 IN 1A	IN
26	P731	ARINC 429 IN 1B	IN
27	P731	ARINC 429 IN 2A	IN
28	P731	ARINC 429 IN 2B	IN
30	P731	ARINC 429 IN 3A	IN
31	P731	ARINC 429 IN 3B	IN
32	P731	ARINC 429 IN 4A	IN
33	P731	ARINC 429 IN 4B	IN

A.3.5.2 RS-232 Input/Output

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5V when driving a standard RS-232 load.

Pin	Connector	Pin Name	I/O
15	P731	MAGNETOMETER RS-232 OUT	OUT
16	P731	RS-232 IN 2	IN
17	P731	RS-232 OUT 2	OUT
18	P731	RS-232 IN 3	IN
19	P731	RS-232 OUT 3	OUT

A.3.5.3 RS-485 Input

The GSU 73 contains one channel of RS-485 serial data communications.

Pin	Connector	Pin Name	I/O
1	P731	MAGNETOMETER RS-485 IN B	IN
2	P731	MAGNETOMETER RS-485 IN A	IN

A.3.5.4 CAN Bus

This data bus conforms to the BOSCH standard for Controller Area Network 2.0-B. This bus complies with ISO 11898. CAN BUS TERMINATION should be connected to CAN BUS LO if GSU is located at the end of the bus.

Pin	Connector	Pin Name	I/O
7	P731	CAN BUS HI	I/O
8	P731	CAN BUS LO	I/O
29	P731	CAN BUS TERMINATION	--

A.3.5.5 Configuration Module Interface

Pin	Connector	Pin Name	I/O
20	P732	CONFIG MODULE CLOCK	OUT
39	P732	CONFIG MODULE DATA	I/O
59	P732	CONFIG MODULE POWER OUT	OUT
78	P732	CONFIG MODULE GROUND	--

A.3.6 Discrete I/O

A.3.6.1 Active Low Discrete Inputs

The GSU 73 has 4 configurable discrete inputs conforming to:

a) Low: 0 VDC < Vin < 3.5 VDC, OR Rin < 375 ohms (active)

b) High: 8 VDC < Vin < 36 VDC, OR Rin> 100k ohms (inactive)

Pin	Connector	Pin Name	I/O
9	P731	DISCRETE IN* 1	IN
10	P731	DISCRETE IN* 2	IN
11	P731	DISCRETE IN* 3	IN
12	P731	DISCRETE IN* 4	IN

* Indicates Active Low

A.3.6.2 Discrete Outputs

INACTIVE: Floating (can be pulled up to externally sourced Vout in the range 0 ≤ Vout ≤ 33VDC)
Leakage current in the INACTIVE state is typically ≤ 10 uA to ground

ACTIVE: Vout ≤ 0.5VDC with ≤ 20 mA sink current
Sink current must be externally limited to 20 mA max

Pin	Connector	Pin Name	I/O
13	P731	DISCRETE OUT* 1	OUT
14	P731	DISCRETE OUT* 2	OUT

* Indicates Active Low

A.3.7 Analog Input Configuration

Some analog inputs are multi-purpose capable and have several configuration options. These inputs are configured automatically at power on by a configuration file stored in the GDU. The following table summarizes the configuration options.

Configurable Parameter	Description/Characteristic
Resistive Divider	Resistive Divider can be enabled or disabled for Analog Input channels 14-25. Enabling & Disabling is achieved via software configuration. *When Disabled*: Hardware scaling is 1:1 and input impedance is greater than 10 MΩ. *When Enabled*: Hardware scaling is approximately 45:1 and input impedance is approximately 100 kΩ.
Voltage Measurement Ranges	There are six voltage measurement ranges for analog inputs: • 25 mV, 55 mV, 100 mV, 1.0 Vdc, 2.5 Vdc, and 5.0 Vdc (Applies to both 1:1 and 45:1 scaling). Effective voltage range in 45:1 mode: • 1.125 Vdc, 2.475 Vdc, 4.5 Vdc, and 45 Vdc.
Bipolar/Unipolar	Each analog input can be configured to measure Bi-Polar (positive and negative) or Uni-Polar (positive only) voltages. All analog inputs are differential.
Constant Current Source	Analog Input channels 12, 13, 22, 23, 24, & 25 can be configured to supply a 250 µA constant current source (CCS) from the positive differential input used to measure resistive sensors. The negative (LO) side of a CCS configured input must be tied to unit ground to provide a current path to ground.
Miscellaneous Sensor Configuration Parameters	• Update Rate • Voltage Translation Equations • Minimum/Maximum Values for Sensors • Hysteresis Value • Digital Filtering Value

NOTE

If installing an ungrounded thermocouple to an Analog In input, a DC reference must be added to the LO input. This can be accomplished by adding a resistance of 1 MΩ or less between ground and the Analog In LO input that the ungrounded thermocouple is installed on.

Pin	Connector	Pin Name	I/O
61	P732	ANALOG IN 1 HI	IN
41	P732	ANALOG IN 1 LO	IN
21	P732	ANALOG IN 2 LO	IN
1	P732	ANALOG IN 2 LO	IN
2	P732	ANALOG IN 3 HI	IN
22	P732	ANALOG IN 3 LO	IN
60	P732	ANALOG IN 4 HI	IN
40	P732	ANALOG IN 4 LO	IN
73	P732	ANALOG IN 5 HI	IN
53	P732	ANALOG IN 5 LO	IN
33	P732	ANALOG IN 6 HI	IN
13	P732	ANALOG IN 6 LO	IN
63	P732	ANALOG IN 7 HI	IN
43	P732	ANALOG IN 7 LO	IN
23	P732	ANALOG IN 8 HI	IN
3	P732	ANALOG IN 8 LO	IN
24	P732	ANALOG IN 9 HI	IN
4	P732	ANALOG IN 9 LO	IN
62	P732	ANALOG IN 10 HI	IN
42	P732	ANALOG IN 10 LO	IN
30	P732	ANALOG IN 11 HI	IN
29	P732	ANALOG IN 11 LO	IN
34	P732	ANALOG IN 12 HI	IN
14	P732	ANALOG IN 12 LO	IN
72	P732	ANALOG IN 13 HI	IN
52	P732	ANALOG IN 13 LO	IN
25	P732	ANALOG IN 14 HI	IN
5	P732	ANALOG IN 14 LO	IN
64	P732	ANALOG IN 15 HI	IN
44	P732	ANALOG IN 15 LO	IN
26	P732	ANALOG IN 16 HI	IN
45	P732	ANALOG IN 16 LO	IN
65	P732	ANALOG IN 17 HI	IN
6	P732	ANALOG IN 17 LO	IN
71	P732	ANALOG IN 18 HI	IN
51	P732	ANALOG IN 18 LO	IN
32	P732	ANALOG IN 19 HI	IN
12	P732	ANALOG IN 19 LO	IN
31	P732	ANALOG IN 20 HI	IN
11	P732	ANALOG IN 20 LO	IN
69	P732	ANALOG IN 21 HI	IN
49	P732	ANALOG IN 21 LO	IN

continued

Pin	Connector	Pin Name	I/O
47	P732	ANALOG IN 22 HI	IN
67	P732	ANALOG IN 22 LO	IN
28	P732	ANALOG IN 23 HI	IN
8	P732	ANALOG IN 23 LO	IN
27	P732	ANALOG IN 24 HI	IN
7	P732	ANALOG IN 24 LO	IN
66	P732	ANALOG IN 25 HI	IN
46	P732	ANALOG IN 25 LO	IN
70	P732	ANALOG/CURRENT MONITOR IN 1 HI	IN
50	P732	ANALOG/CURRENT MONITOR IN 1 LO	IN
48	P732	ANALOG/CURRENT MONITOR IN 2 HI	IN
68	P732	ANALOG/CURRENT MONITOR IN 2 LO	IN
10	P732	THERMOCOUPLE REF IN HI	IN
9	P732	THERMOCOUPLE REF IN LO	IN

A.3.8 Temperature Inputs

Temperature input is used for Outside Air Temperature (OAT) computations. The temperature input is a three-wire temperature probe interface. OAT Power Out and OAT High are connected internally at the OAT probe. A GTP 59 or other supported temperature probe is required for the GSU 73 installation. The GTP 59 is a Resistive Temperature Device (RTD). Refer to Figure **C-1??????** for the temperature probe interconnect.

Pin	Connector	Pin Name	I/O
15	P732	OAT PROBE IN HI	IN
16	P732	OAT PROBE POWER OUT	OUT
35	P732	OAT PROBE IN LO	IN

A.3.9 Frequency Counter Inputs

Digital signals are updated to the display at a rate of 10 times per second (10 Hz). Digital inputs are low when the signal is ≤ 2 Vdc or the resistance to ground is ≤ 375 Ω, and high when the signal is > 3.5 Vdc or the resistance to ground is > 100 k Ω. Digital inputs can also be configured as discrete inputs.

Pin	Connector	Pin Name	I/O
17	P732	FREQUENCY COUNTER IN* 1	IN
19	P732	FREQUENCY COUNTER IN* 2	IN
36	P732	FREQUENCY COUNTER IN* 3	IN
38	P732	FREQUENCY COUNTER IN* 4	IN

* Indicates Active Low

The following table lists the minimum frequency, maximum frequency, and duty cycles for each of these inputs.

Pin Name	Minimum Frequency	Maximum Frequency	Duty Cycle
FREQUENCY COUNTER IN* 1	1 Hz	500 Hz/100 KHz*	50%
FREQUENCY COUNTER IN* 2	1 Hz	500 Hz/100 KHz*	50%
FREQUENCY COUNTER IN* 3	1 Hz	500 Hz/100 KHz*	50%
FREQUENCY COUNTER IN* 4	1 Hz	500 Hz/100 KHz*	50%

*Each frequency counter channel will be configured for a high or low speed input based on the signal being measured.

A.3.10 Fuel Select Outputs

Pin	Connector	Pin Name	I/O
76	P732	RESERVED (FUEL SENSOR PULL-UP 2 (ANALOG IN 15))	OUT
77	P732	RESERVED (FUEL SENSOR PULL-UP 1 (ANALOG IN 14))	OUT

APPENDIX B Connector Installation Instructions

B.1 Thermocouple Installation into a Backshell

Table B-1 lists parts needed to install a Thermocouple. Parts for this installation are included in the Thermocouple Kit (011-00981-00), which is included in the G3X Installation Kit (K10-00017-00).

Table B-1. Thermocouple Kit GPN 011-00981-00

Figure Ref	Description	Qty. Needed	PN or MIL spec
1	3" Thermocouple, K type	1	925-L0000-00
2	Pins #22 AWG	2	336-00021-00
3	Screw	1	211-60234-08

NOTE

For the following steps please refer to indicated item numbers in Figures B-1, and B-2.

1. Strip back approximately 0.17 inches of insulation from both the positive and negative thermocouple leads (item 1) and crimp a pin (item 2) to each lead. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-1.

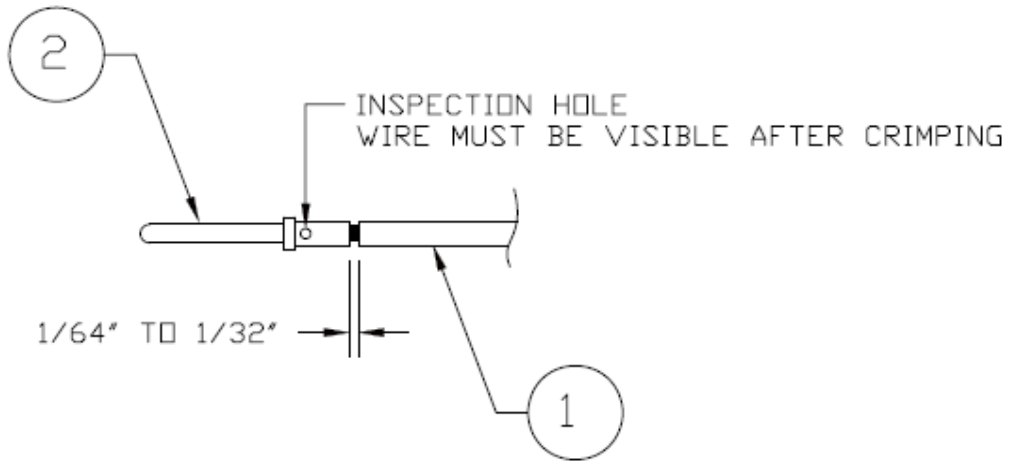


Figure B-1. Insulation/Contact Clearance

2. Insert newly crimped pins and wires (items 1 & 2) into the appropriate connector housing (item 4) location as specified by the installation specific wiring diagram.
3. Place thermocouple (item 1) body onto backshell (item 5) boss. Upon placing the thermocouple (item 1) body, orient it such that the wires exit downward.
4. Attach thermocouple (item 1) tightly to backshell (item 5) using screw (item 3).
5. Attach cover (item 6) to backshell (item 5) using screws (item 7).

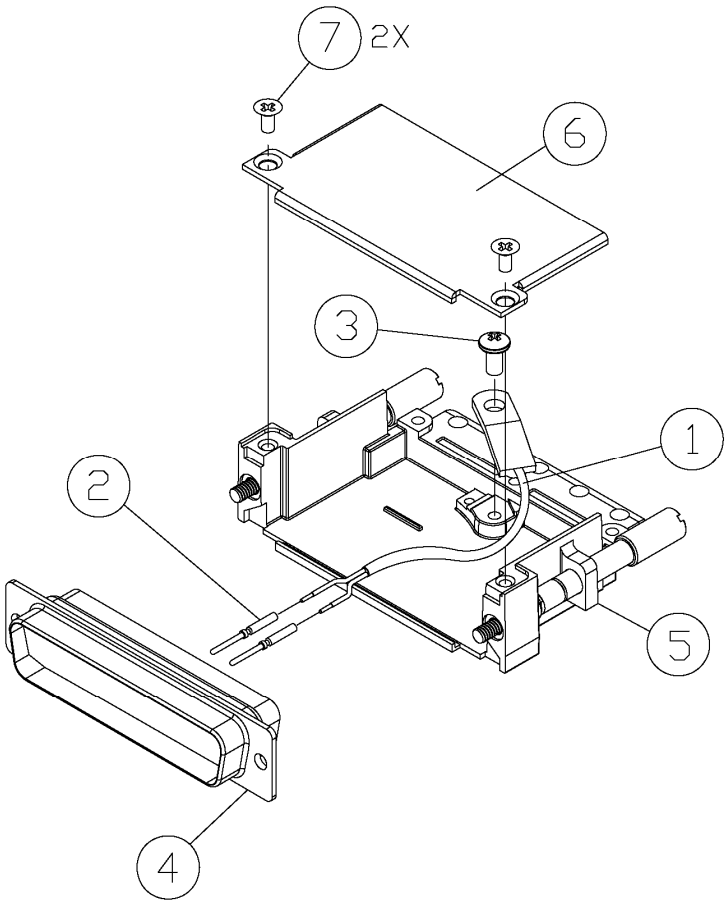


Figure B-2. Jackscrew Backshell Thermocouple Installation

B.2 Jackscrew Configuration Module Installation into a Jackscrew Backshell

Tables B-2 & B-3 list parts needed to install a Jackscrew Configuration Module with pins or with sockets. Parts for these installations are included in the 011-00979-20 and 011-00979-22 kits, which are included in the G3X Installation Kit (K10-00017-00).

Configuration modules are to be installed in the backshells of the P732 connector for the GSU 73, and the P3701 connector for the GDU 37X designated as PFD1.

Table B-2. GPN: 011-00979-20 – Kit (w/EEPROM and pins)

Figure Ref	Description	Qty. Needed	GPN or MIL spec
1	Potted Module (w/EEPROM and Temp.sensor)	1	011-02179-00
3	4 cond. Cable harness	1	325-00122-00
4	Pins Size 22D	4	336-00021-00
10	Pan head screw	1	211-60232-07

Table B-3. GPN: 011-00979-22 – Kit (w/EEPROM and sockets)

Figure Ref	Description	Qty. Needed	GPN or MIL spec
1	Potted Module (w/EEPROM and Temp.sensor)	1	011-02179-00
3	4 cond. Cable harness	1	325-00122-00
9	Socket, Size 20, 26-30 AWG	4	336-00022-01
10	Pan head screw	1	211-60232-07

NOTES

For the following steps please refer to Figures B-3 & B-4.

1. Strip back approximately 0.17 inches of insulation from each wire of the four conductor wire harness (item 3) and crimp either a pin (item 4) or a socket (item 9) to each conductor. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-3.

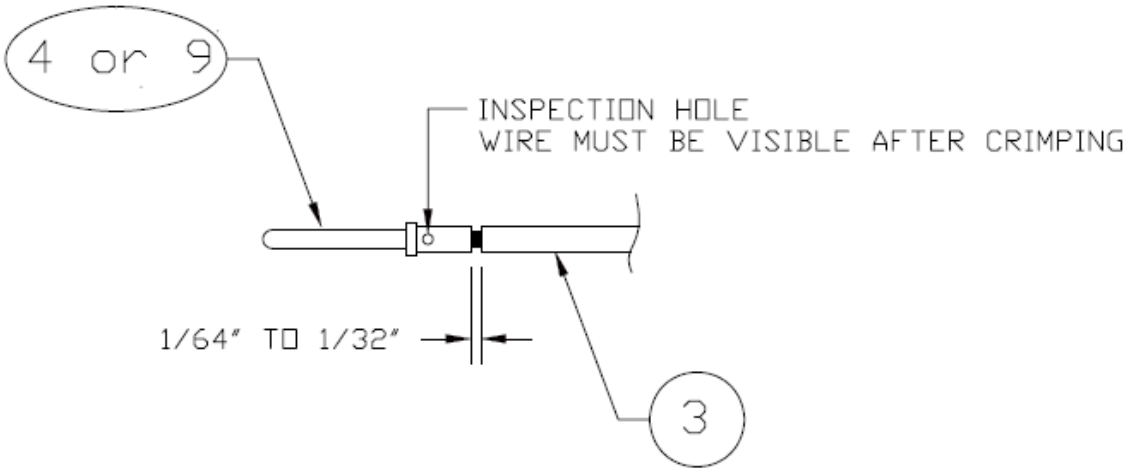


Figure B-3. Insulation/Contact Clearance

2. Insert newly crimped pins (or sockets) and wires (items 3 and 4) into the appropriate connector housing (item 5) location as specified by the installation specific wiring diagram.
3. Attach the module (item 1) to backshell (item 6) using screw (item 10).
4. Plug the four conductor wire harness (item 3) into the connector on the module (item 1).
5. Orient the connector housing (item 5) so that the inserted four conductor wire harness (item 3) is on the same side of the backshell (item 6) as the module (item 1)—as shown in drawing.
6. Attach cover (item 7) to backshell (item 6) using screws (item 8).

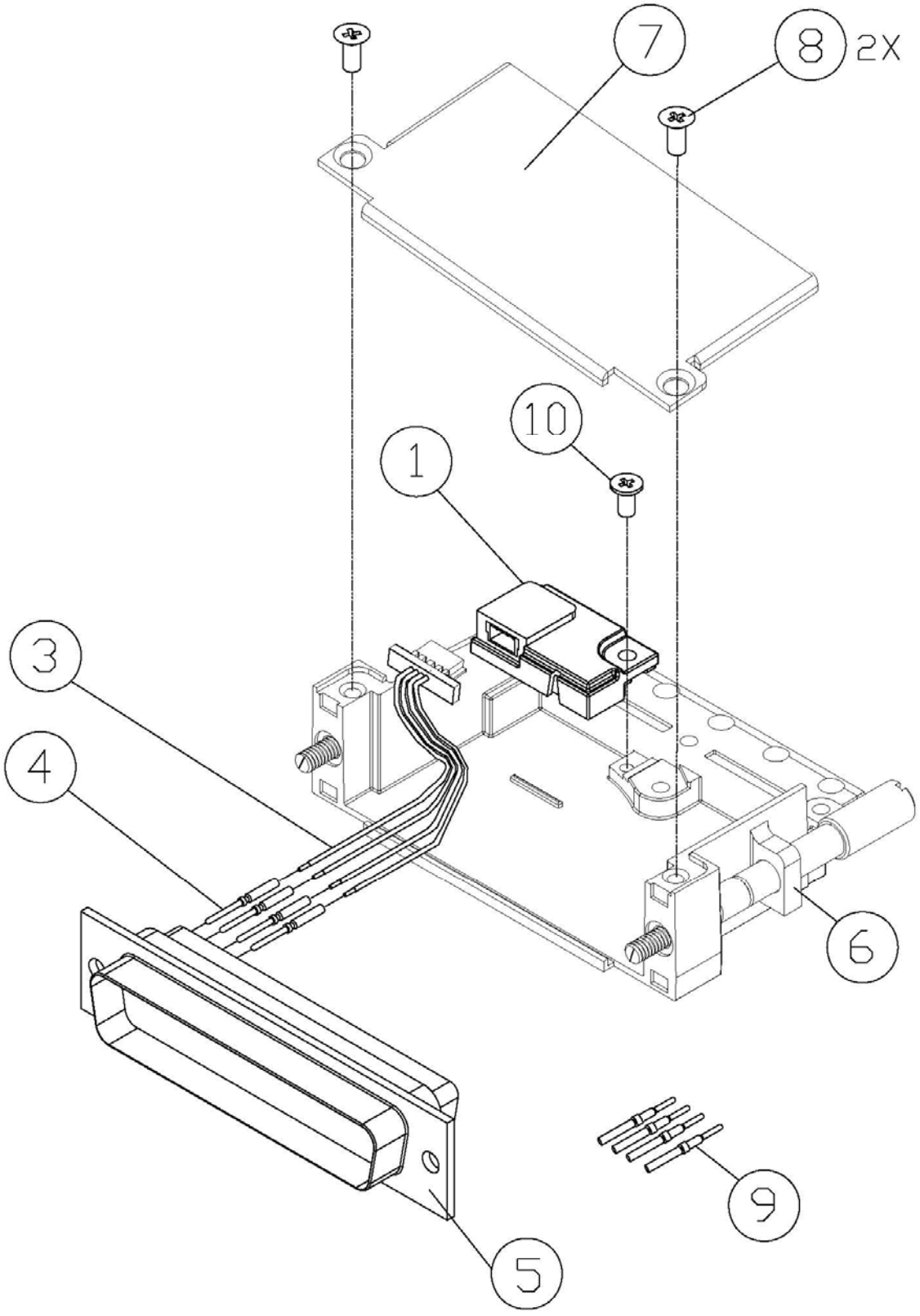


Figure B-4. Jackscrew Backshell Installation

B.3 Jackscrew Backshell Installation Instructions

B.3.1 Shield Block Installation Parts

Tables B-4 and B-5 list the parts needed to install a Shield Block. Parts listed in Table B-4 are supplied in the jackscrew backshell kits (011-01855-03 and 011-01855-04). Parts listed in Table B-5 are to be provided by the installer.

Table B-4. Parts supplied for a Shield Block Installation (Figure B-1)

Figure Ref	Description	GPN or MIL spec for 011-01855-03	GPN or MIL spec For 011-01855-04
1	Cast Backshell Housing	125-00174-00	125-00175-00
6	Contacts	336-00094-00	336-00094-00
12	Clamp	115-01078-03	115-01078-04
13	Screw,4-40x.375,PHP,SS/P,w/Nylon	211-60234-10	211-60234-10
14	Cover	115-01079-03	115-01079-04
15	Screw,4-40x.187,FLHP100,SS/P,w/Nylon	211-63234-06	211-63234-06

Table B-5. Parts NOT supplied for a Shield Block Installation (Figure B-1)

Figure Ref	Description	GPN or MIL spec
2	Multiple Conductor Shielded Cable (2-conductor shown in Figure B-1)	Parts used depend on method chosen
3	Drain Wire Shield Termination (method optional)	Parts used depend on method chosen
4	Braid, Flat (19-20 AWG equivalent, tinned plated copper strands 36 AWG, Circular Mil Area 1000 -1300)	Parts used depend on method chosen
5	Floating Shield Termination (method optional)	Parts used depend on method chosen
7	Ring terminal, #8, insulated, 18-22 AWG	MS25036-149
	Ring terminal, #8, insulated, 14-16 AWG	MS25036-153
	Ring terminal, #8, insulated, 10-12 AWG	MS25036-156
8	Screw, PHP, 8-32x.312", Stainless	MS51957-42
	Screw, PHP, 8-32x.312", Cad Plated Steel	MS35206-242
9	Split Washer, #8, (.045" compressed thickness) Stainless	MS35338-137
	Split Washer, #8, (.045" compressed thickness) Cad-plated steel	MS35338-42
10	Flat Washer, Stainless, #8, .032" thick, .174"ID, .375" OD	NAS1149CN832R
	Flat washer, Cad-plated Steel, #8, .032" thick, .174"ID, .375" OD	NAS1149FN832P
11	Silicon Fusion Tape	-

NOTE

In Figure B-5, "AR" denotes quantity "As Required" for the particular installation.

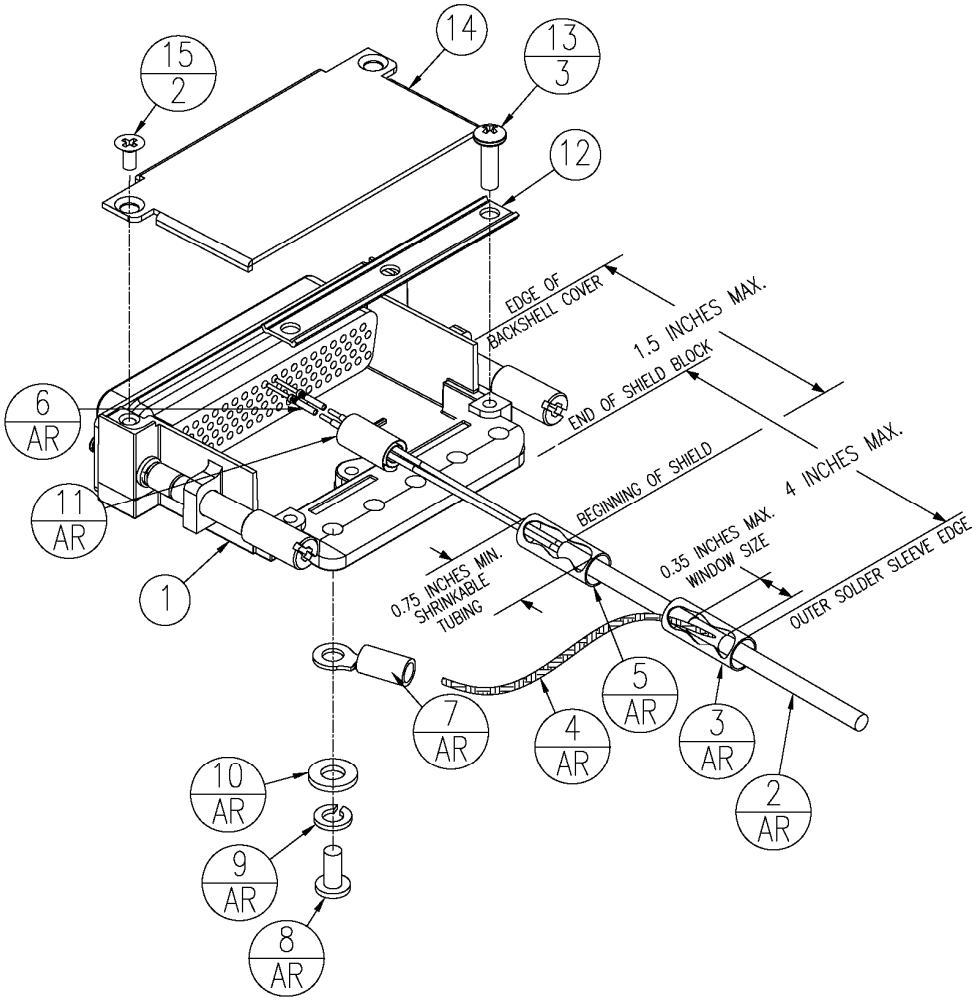


Figure B-5. Shield Install onto a Jackscrew Backshell (78 pin example)

B.3.2 Shield Termination Technique – Method A.1 (Standard)

NOTE

For the following steps please refer to the drawings showing the installation of a Jackscrew Backshell.

1. The appropriate number of Jackscrew Backshells will be included in the particular LRU connector kit.

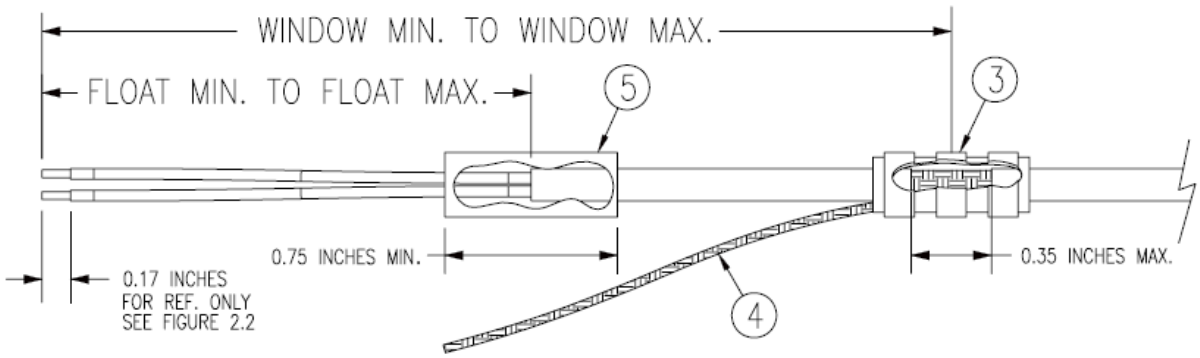


Figure B-6. Method A.1 for Shield Termination

Table B-6. Shielded Cable Preparations for Garmin Connectors

Backshell Size	Number of Pins Std/HD	Float Min (inches)	Float Max (inches)	Ideal Float (inches)	Window Min (inches)	Window Max (inches)	Ideal Window (inches)
1	9/15	1.25	2.25	1.75	2.75	5.25	4.25
2	15/26	1.5	2.5	2.0	3.0	5.5	4.5
3	25/44	1.5	2.5	2.0	3.0	5.5	4.5
4	37/62	1.5	2.5	2.0	3.0	5.5	4.5
5	50/78	1.5	2.5	2.0	3.0	5.5	4.5

2. At one end of a shielded cable (item 2) measure a distance between “Window Min” to “Window Max” (Table B-6) and cut a window (max size 0.35”) in the jacket to expose the shield (Figure B-6). Use caution when cutting the jacket to avoid damaging the individual braids of the shield. When dealing with a densely populated connector with many cables, it may prove beneficial to stagger the windows throughout the “Window Min” to “Window Max” range. If staggering is not needed the “Ideal Window” length is recommended.

   Suggested tools to accomplish the window cut:

   - Coaxial Cable Stripper
   - Thermal Stripper
   - Sharp Razor Blade

3. Connect a Flat Braid (item 4) to the shield exposed through the window of the prepared cable assembly (item 2) from step 2. The Flat Braid should go out the front of the termination towards the connector. It is not permitted to exit the rear of the termination and loop back towards the connector (Figure B-6). Make this connection using an approved shield termination technique.

NOTE

FAA AC 43.13-1B Chapter 11, Section 8 (Wiring Installation Inspection Requirements) may be a helpful reference for termination techniques.

Preferred Method:

Slide a solder sleeve (item 3) onto the prepared cable assembly (item 2) and connect the Flat Braid (item 4) to the shield using a heat gun approved for use with solder sleeves. It may prove beneficial to use a solder sleeve with a pre-installed Flat Braid versus having to cut a length of Flat Braid to be used. The chosen size of solder sleeve must accommodate both the number of conductors present in the cable and the Flat Braid (item 4) to be attached.

Solder Sleeves with pre-installed Flat Braid

A preferred solder sleeve would be the Raychem S03 Series with the thermochromic temperature indicator (S03-02-R-9035-100, S03-03-R-9035-100, S03-04-R-9035-100). These solder sleeves come with a pre-installed braid and effectively take the place of items 3 and 4. For detailed instructions on product use, reference Raychem installation procedure RCPS 100-70.

Raychem recommended heating tools:

- HL1802E
- AA-400 Super Heater
- CV-1981
- MiniRay
- IR-1759

Individual solder sleeves and Flat Braid

Solder Sleeves:

Reference the following MIL-Specs for solder sleeves.
(M83519/1-1, M83519/1-2, M83519/1-3, M83519/1-4, M83519/1-5)

Flat Braid:

If the preferred Raychem sleeves are not being used, the individual flat braid selected should conform to ASTMB33 for tinned copper and be made up of 36 AWG strands to form an approximately 19-20 AWG equivalent flat braid. A circular mil area range of 1000 to 1300 is required. The number of individual strands in each braid bundle is not specified. (e.g. QQB575F36T062)

NOTE

Flat Braid as opposed to insulated wire is specified in order to allow continuing air worthiness by allowing for visual inspection of the conductor.

Secondary Method:
Solder a Flat Braid (item 4) to the shield exposed through the window of the prepared cable assembly (item 2). Ensure a solid electrical connection through the use of acceptable soldering practices. Use care to avoid applying excessive heat that burns through the insulation of the center conductors and shorts the shield to the signal wire. Slide a minimum 0.75 inches of Teflon heat shrinkable tubing (item 3) onto the prepared wire assembly and shrink using a heat gun. The chosen size of heat shrinkage tubing must accommodate both the number of conductors present in the cable and the Flat Braid (item 4) to be attached.

Teflon Heat Shrinkable Tubing:

Reference the following MIL-Spec for Teflon heat shrinkable tubing (M23053/5-X-Y).

4. At the same end of the shielded cable (item 2) and ahead of the previous shield termination, strip back "Float Min" to "Float Max" (Table B-6) length of jacket and shield to expose the insulated center conductors (Figure B-6). The "Ideal Float" length may be best to build optimally.

Preferred Method:
The jacket and shield should be cut off at the same point so no shield is exposed. Slide 0.75 inches minimum of Teflon heat shrinkable tubing (item 5) onto the cable and use a heat gun to shrink the tubing. The chosen size of heat shrinkage tubing must accommodate the number of conductors present in the cable.

Secondary Method:
Leave a max 0.35 inches of shield extending past the jacket. Fold this 0.35 inches of shield back over the jacket. Slide a solder sleeve (item 5) over the end of the cable and use a heat gun approved for solder sleeves to secure the connection. The chosen size of solder sleeve must accommodate the number of conductors present in the cable.

5. Strip back approximately 0.17 inches of insulation from each wire of the shielded cable (item 2) and crimp a contact (item 6) to each conductor. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-7.

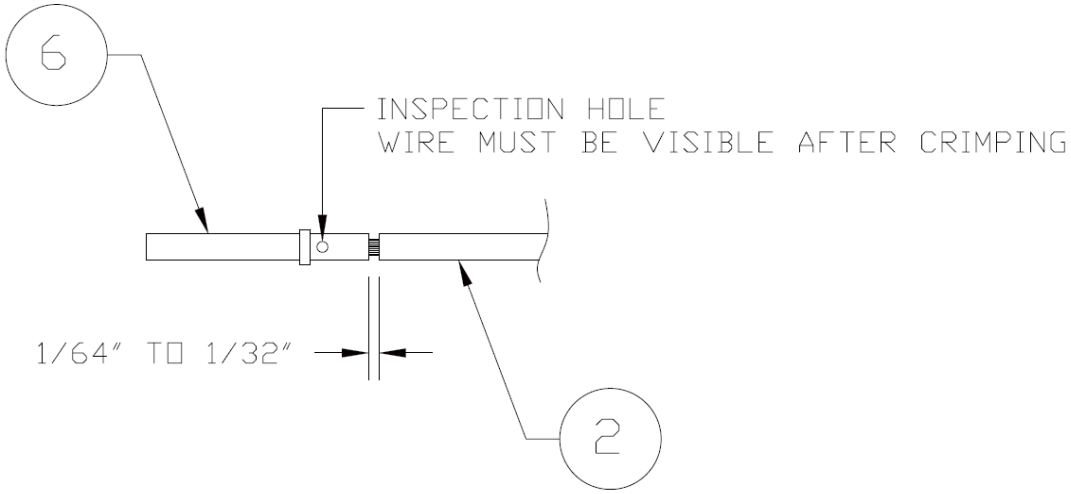


Figure B-7. Insulation/Contact Clearance

6. Insert newly crimped pins and wires into the appropriate connector housing location as specified by the installation wiring diagrams.
7. Cut the Flat Braid (item 4) to a length that, with the addition of a ring terminal, will reach one of the tapped holes of the Jackscrew backshell (item 1) (Figure B-5). An appropriate amount of excess length without looping should be given to the Flat Braid (item 4) to allow it to freely move with the wire bundle.

NOTE

Position the window splice to accommodate a Flat Braid (item 4) length of no more than 4 inches.

8. Guidelines for terminating the newly cutoff Flat Braid(s) (item 4) with insulated ring terminals (item 7):
   - Each tapped hole on the Jackscrew Backshell (item 1) may accommodate only two ring terminals (item 7).
   - It is preferred that only two Flat Braid(s) (item 4) be terminated per ring terminal. Two Flat Braids per ring terminal will necessitate the use of a Ring terminal, #8, insulated, 14-16 AWG (MS25036-153).
   - If only a single Flat Braid is left or if only a single Flat Braid is needed for this connector a Ring terminal, #8, insulated, 18-22 AWG (MS25036-149) can accommodate this single Flat Braid.
   - If more braids exist for this connector than two per ring terminal, it is permissible to terminate three braids per ring terminal. This will necessitate the use of a Ring terminal, #8, insulated, 10-12 AWG (MS25036-156).
9. Repeat steps 2 through 8 as needed for the remaining shielded cables.
10. Terminate the ring terminals to the Jackscrew Backshell (item 1) by placing items on the Pan Head Screw (item 8) in the following order: Split Washer (item 9), Flat Washer (item 10) first Ring Terminal, second Ring Terminal (if needed) before finally inserting the screw into the tapped holes on the Jackscrew Backshell. Do not violate the guidelines presented in Step 8 regarding ring terminals.
11. It is recommended to wrap the cable bundle with Silicone Fusion Tape (item 11) (GPN: 249-00114-00 or a similar version) at the point where the backshell clamp and cast housing will contact the cable bundle.

NOTE

Choosing to use this tape is the discretion of the installer.

12. Place the smooth side of the backshell clamp (item 12) across the cable bundle and secure using the three screws (item 13). Warning: Placing the grooved side of the clamp across the cable bundle may risk damage to wires.
13. Attach the cover (item 14) to the backshell (item 1) using the two screws (item 15).

B.3.3 Shield Termination Technique - Method A.2 (Daisy Chain)

In rare situations where more braids need to be terminated for a connector than three per ring terminal it is allowable to daisy chain a maximum of two shields together before coming to the ring terminal (Figure B-8). All other restrictions and instructions for the shield termination technique set forth for Method A.1 are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

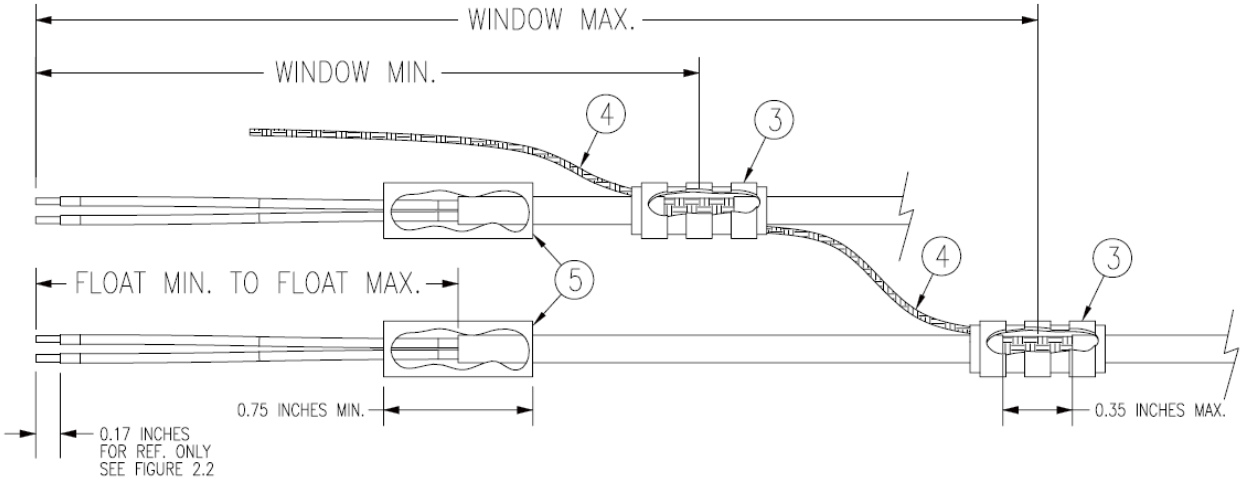


Figure B-8. Method A.2 (Daisy Chain) for Shield Termination

B.3.4 Shield Termination – Method B.1 (Quick Term)

If desired, the drain wire termination (item 3) and the floating shield termination (item 5) can be effectively combined into a "Quick Term". This method eliminates the float in the cable insulation and moves the placement of the window which was described by the dimensions "Window Min" and "Window Max" from Method A. This technique is depicted in Figure B-9.

NOTE

The original purpose for separating the shield drain termination (item 3) from the float termination (item 5) in Method A was to allow for a variety of lengths for the drain wires so that the shield drain terminations (item 3) would not all "bunch up" in the harness and to eliminate loops in the drain wires. If Method B is chosen, as described in this section, care must be taken to insure that all drain shield terminations can still be inspected. With connectors which require a large number of shield terminations it may be best to use Method A. This will allow the drain shield terminations (item 3) a larger area to be dispersed across.

Using this method, the instructions from Section B.3.2 (Method A) are followed except that:

1. Step 2 is eliminated
2. Steps 3 and 4 are replaced by the following:

   At the end of the shielded cable (item 2), strip "Quick Term Min" to "Quick Term Max" (Table B-7) length of the jacket to expose the shield. Next trim the shield so that at most 0.35 inches remains extending beyond the insulating jacket. Fold this remaining shield back over the jacket.

Connect a Flat Braid (item 4) to the folded back shield of the prepared cable assembly. The flat braid should go out the front of the termination towards the connector. It is not permitted to exit the rear of the termination and loop back towards the connector. (Figure B-9). Make this connection using an approved shield termination technique.

NOTE

FAA AC 43.13-1B Chapter 11, Section 8 (Wiring Installation Inspection Requirements) may be a helpful reference for termination techniques.

Preferred Method:

Slide a solder sleeve (item 3) onto the prepared cable assembly (item 2) and connect the Flat Braid (item 4) to the shield using a heat gun approved for use with solder sleeves. It may prove beneficial to use a solder sleeve with a pre-installed Flat Braid versus having to cut a length of Flat Braid to be used. The chosen size of solder sleeve must accommodate both the number of conductors present in the cable and the Flat Braid (item 4) to be attached.

NOTE

Reference Section B.3.2 for recommended solder sleeves and flat braid. The same recommendations are applicable to this technique.

Secondary Method:

Solder a Flat Braid (item 4) to the folded back shield on the prepared cable assembly (item 2). Ensure a solid electrical connection through the use of acceptable soldering practices. Use care to avoid applying excessive heat that burns through the insulation of the center conductors and shorts the shield to the signal wire. Slide a minimum of 0.75 inches of Teflon heat shrinkable tubing (item 3) onto the prepared wire assembly and shrink using a heat gun. The chosen size of heat shrinkage tubing must accommodate both the number of conductors present in the cable as well as the Flat Braid (item 4) to be attached.

Teflon Heat Shrinkable Tubing:

Reference the following MIL-Spec for general Teflon heat shrinkable tubing (M23053/5-X-Y)

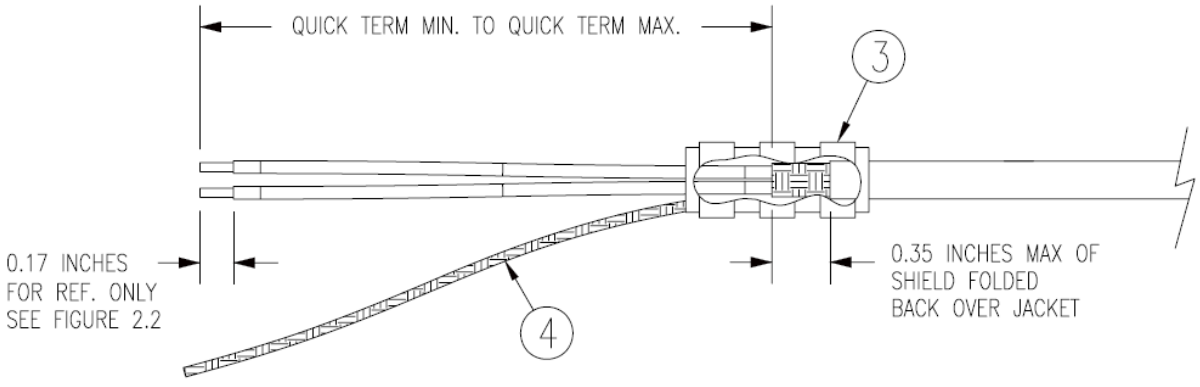


Figure B-9. Method B.1 (Quick Term) for Shield Termination

Table B-7. Shielded Cable Preparations – (Quick Term)

Backshell Size	Number of Pins Std/HD	Quick Term Min (inches)	Quick Term Max (inches)	Quick Term Float (inches)
1	9/15	1.25	2.25	1.75
2	15/26	1.5	2.5	2.0
3	25/44	1.5	2.5	2.0
4	37/62	1.5	2.5	2.0
5	50/78	1.5	2.5	2.0

B.3.5. Shield Termination-Method B.2 (Daisy Chain-Quick Term)

In rare situations where more braids need to be terminated for a connector than three per ring terminal it is allowable to daisy chain a maximum of two shields together before coming to the ring terminal (Figure B-10). All other restrictions and instructions for the shield termination technique set forth for Method B.1 are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

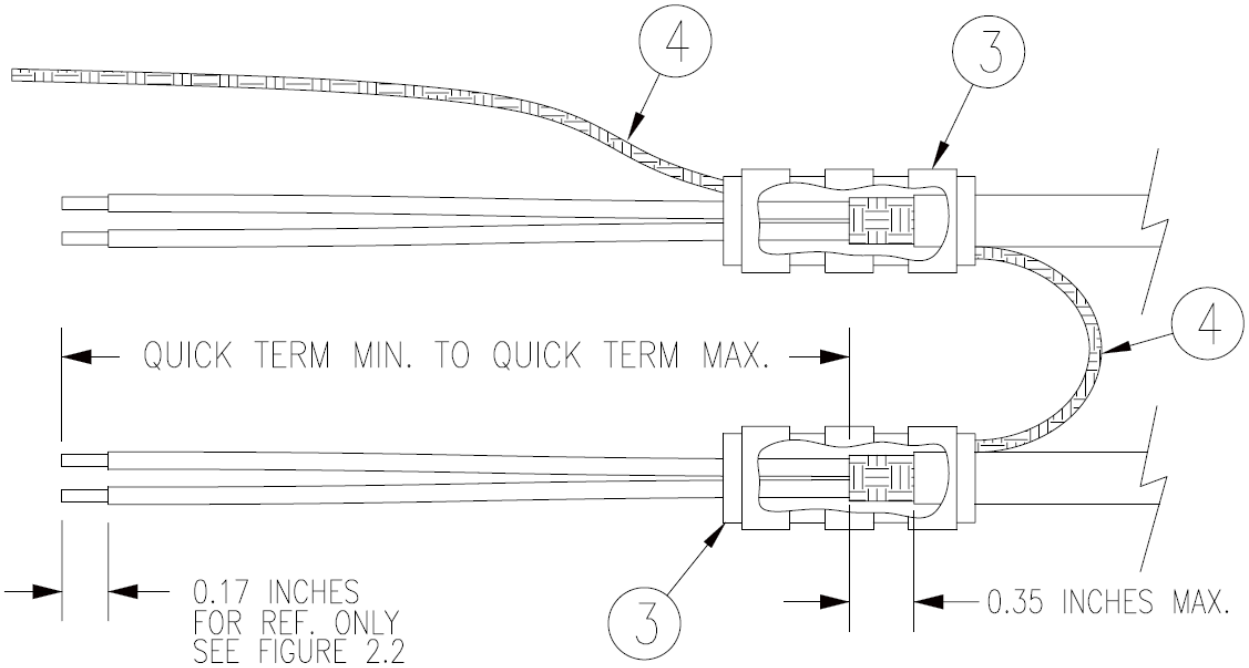


Figure B-10. Method B.2 (Daisy Chain-Quick Term) for Shield Termination

B.3.6. Daisy Chain between Methods A and B

In rare situations where more braids need to be terminated for a connector than three per ring terminal and a mixture of Methods A and B have been used, it is allowable to daisy chain a maximum of two shields together from a Method A termination to a Method B (Figure B-11). All other restrictions and instructions for the shield termination technique set forth for Method A and B are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

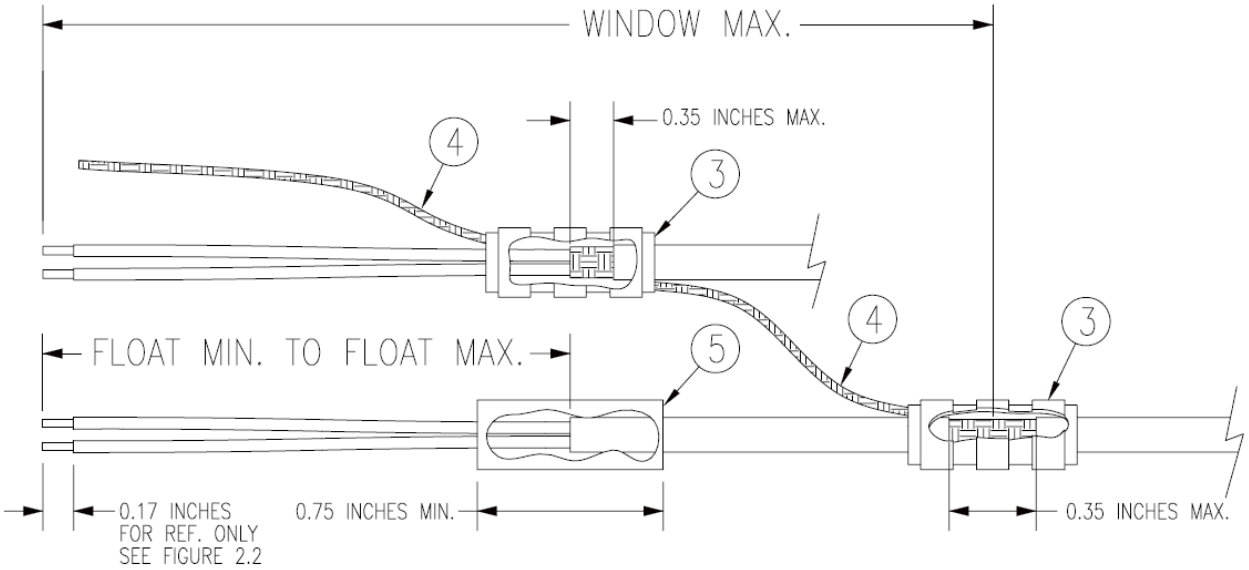


Figure B-11. Daisy Chain between Methods A and B

B.3.7 Double-Shield Termination Technique - Method C.1

In rare situations where double shielding may be necessary, the outer shield should be grounded at both ends, while the inner shield should be grounded only at one end.

All other restrictions set forth for in Table B-8 are applicable.

NOTE

The maximum length of the braids should be approximately 4 inches.

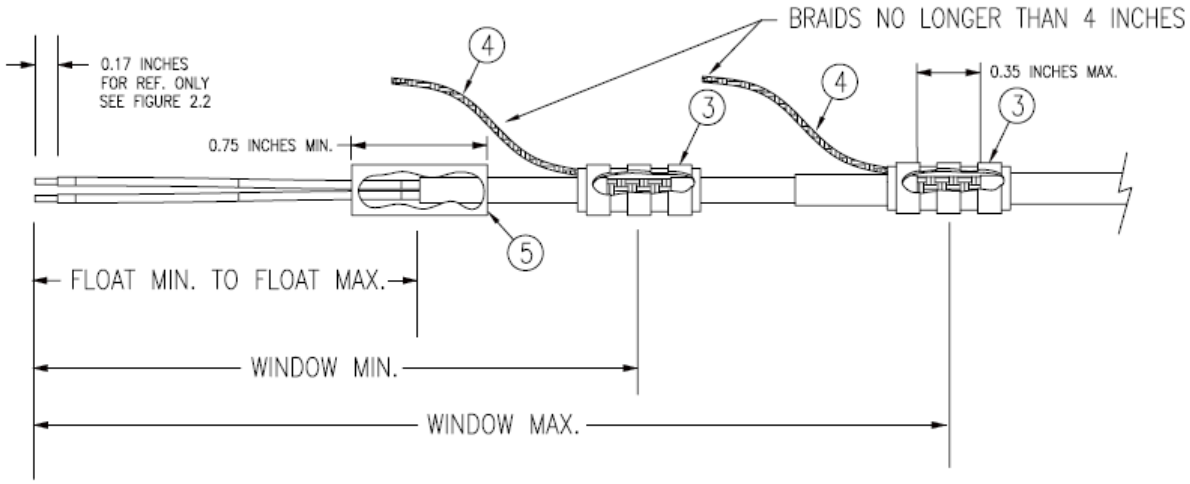


Figure B-12. Method C.1 Double-Shield Termination

Table B-8. Shielded Cable Preparations for Garmin Connectors

Backshell Size	Number of Pins Std/HD	Float Min (inches)	Float Max (inches)	Ideal Float (inches)	Window Min (inches)	Window Max (inches)
1	9/15	1.25	2.25	1.75	2.75	5.25
2	15/26	1.5	2.5	2.0	3.0	5.5
3	25/44	1.5	2.5	2.0	3.0	5.5
4	37/62	1.5	2.5	2.0	3.0	5.5
5	50/78	1.5	2.5	2.0	3.0	5.5

B.3.8 Double-Shield Termination Technique (Quick Term) - Method C.2

In addition to method C.1, described previously, another suitable method for double-shielding wires is presented in Figure B-13. All restrictions set forth for Method C.1 (Table B-8) are still applicable.

NOTE

The maximum length of the braids should be approximately 4 inches.

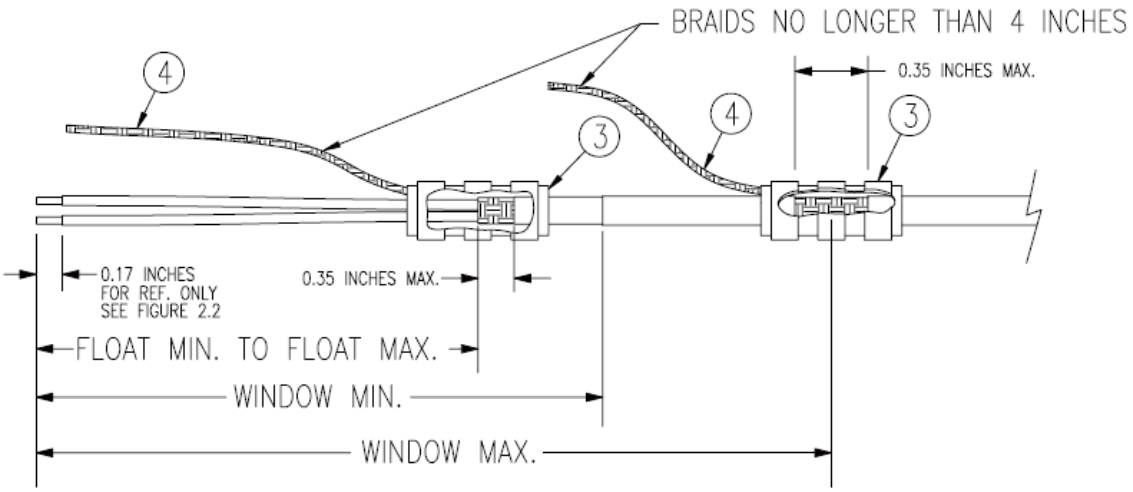


Figure B-13. Method C.2 Double-Shield Termination

B.3.9 ID Program Pins (Strapping)

ID Program Pins provide a ground reference used by the hardware as a means of configuration for system identification. The following instructions will illustrate how this ground strapping should be accomplished with the Jackscrew Backshell:

1. Cut a 4 inch length of 22 AWG insulated wire.

   WARNING

   Flat Braid is not permitted for this purpose. Use only insulated wire to avoid inadvertent ground issues that could occur from exposed conductors.

2. Strip back approximately 0.17 inches of insulation and crimp a contact (item 6) to the 4" length of 22 AWG insulated wire. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-7.
3. Insert newly crimped pins and wires into the appropriate connector housing location as specified by the installation wiring diagrams.
4. At the end opposite the pin on the 22 AWG insulated wire strip back 0.2 inches of insulation.
5. Terminate this end via the ring terminals with the other Flat Braid per Steps 8 and 11 pertaining to shield termination. If this ground strap is only wire to terminate, attach a Ring terminal, #8, insulated, 18-22 AWG (MS25036-149).

B.3.10 Splicing Signal Wires

NOTES

Figure B-14 illustrates that a splice must be made within a 3 inch window from outside the edge of clamp to the end of the 3 inch max mark.

WARNING

Keep the splice out of the backshell for pin extraction, and outside of the strain relief to avoid preloading.

Figure B-14 shows a two wire splice, but a maximum of three wires can be spliced. If a third wire is spliced, it is located out front of splice along with signal wire going to pin.

Splice part numbers:

Raychem D-436-36/37/38
MIL Spec MIL-S-81824/1

This technique may be used with shield termination methods: A.1, A.2, B.1, B.2, C.1 and C.2.

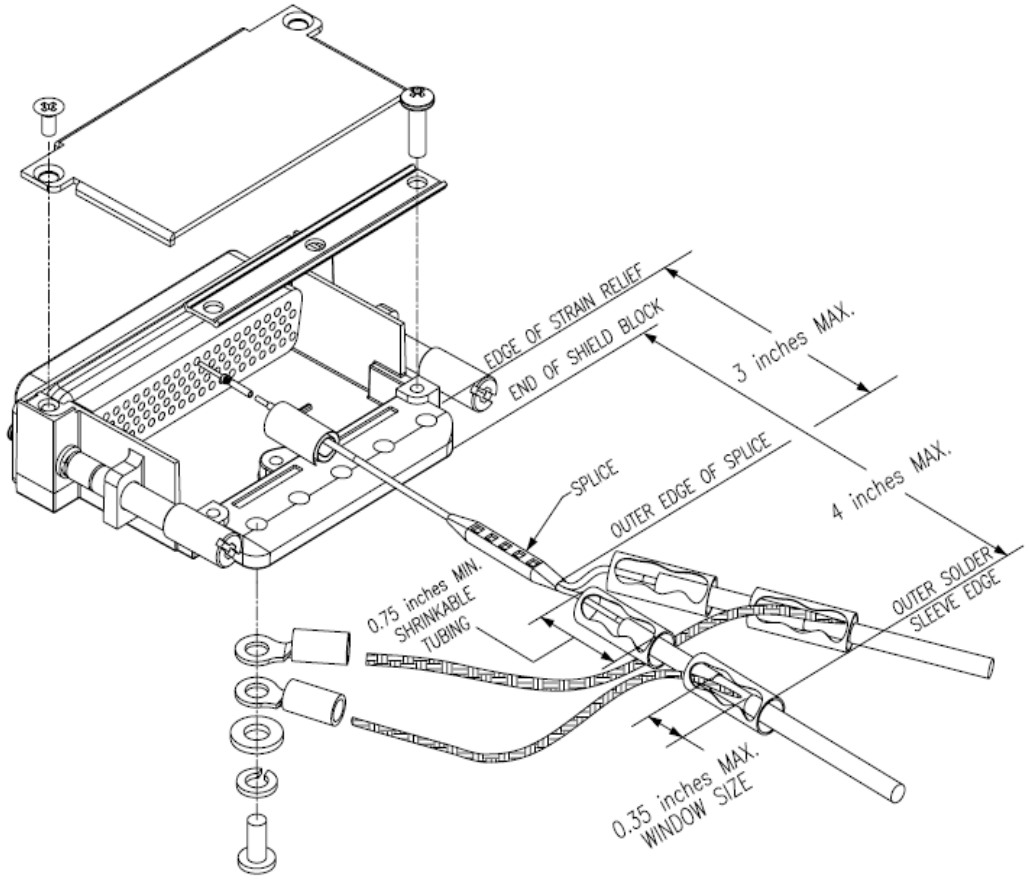


Figure B-14. D-Sub Spliced Signal Wire illustration

B.4 Circular Connector Installation Instructions

B.4.1 Pigtail Installation Parts

Table B-9 provides a list of parts needed to install a circular connector with backshell. Parts for this installation are included in the pigtail connector kits and some are to be provided by the OEM/installer.

Table B-9. Parts supplied for a Circular Connector Installation (Figure B-15)

Figure Ref	Description	GPN or MIL spec
2	Contacts	336-00022-00
3	Circular Backshell Non-Magnetic (includes 2 self-tapping screws and circular connector)	330-90005-01

Table B-10. Parts NOT supplied for a Circular Connector Installation (Figure B-15)

Figure Ref	Description	GPN or MIL spec
1	Circular Connector, 19 CKT	MS3474L14-19SW
4	Multiple Conductor Shielded Cable (2 conductor shown in Figure B-15)	Reference Installation Wiring Diagrams
5	Drain Wire Shield Termination (method optional)	Parts used depend on method chosen
6	Braid, Flat (19-20 AWG equivalent, tinned plated copper strands 36 AWG, Circular Mil Area 1000 -1300)	Parts used depend on method chosen
7	Floating Shield Termination (method optional)	Parts used depend on method chosen
8	Ring terminal, #6, insulated, 18-22 AWG	MS25036-102
	Ring terminal, #6, insulated, 14-16 AWG	MS25036-107
	Ring terminal, #6, insulated, 10-12 AWG	MS25036-111

NOTE

In Figure B-15, "AR" denotes quantity "As Required" for the particular installation.

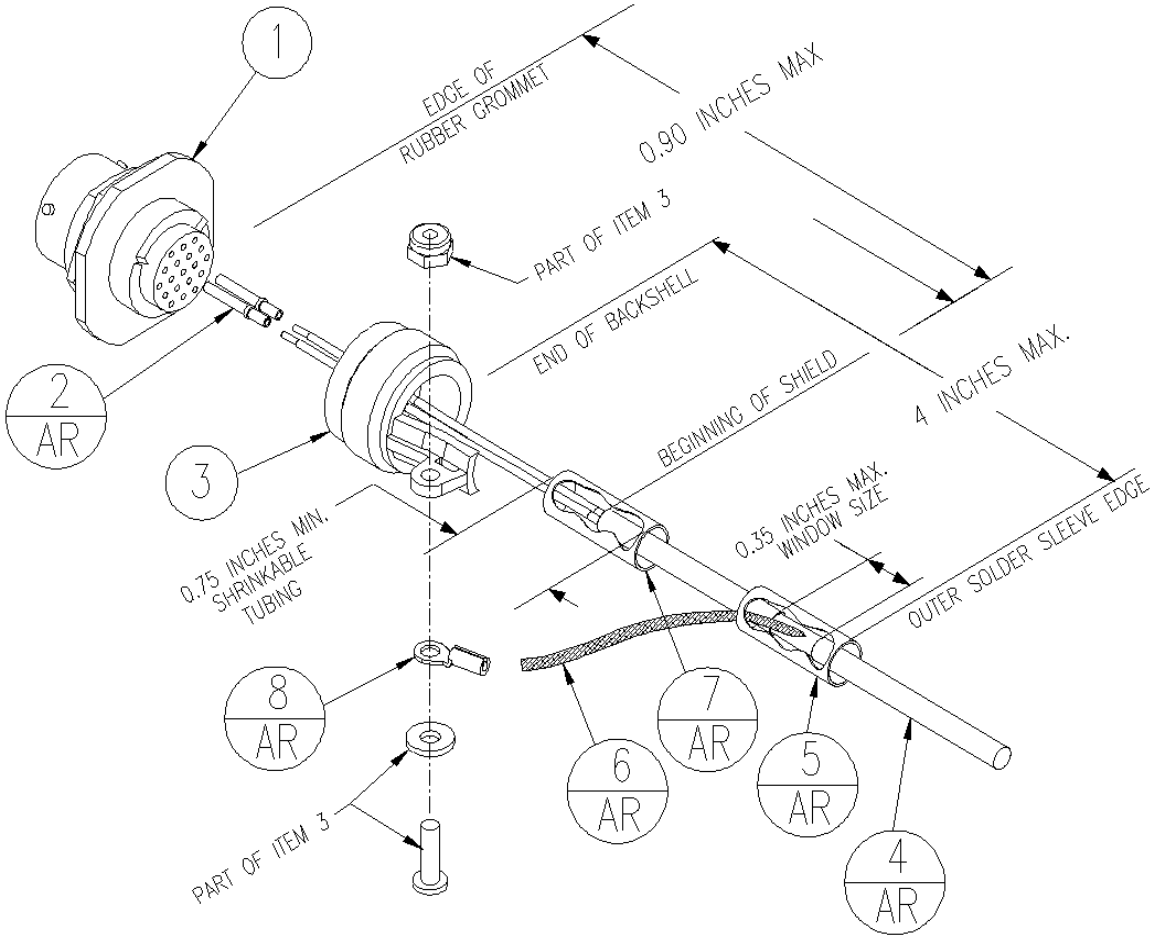


Figure B-15. Circular Connector Install (19 contact example)

B.4.2 Standard Shield Termination Technique – Method A

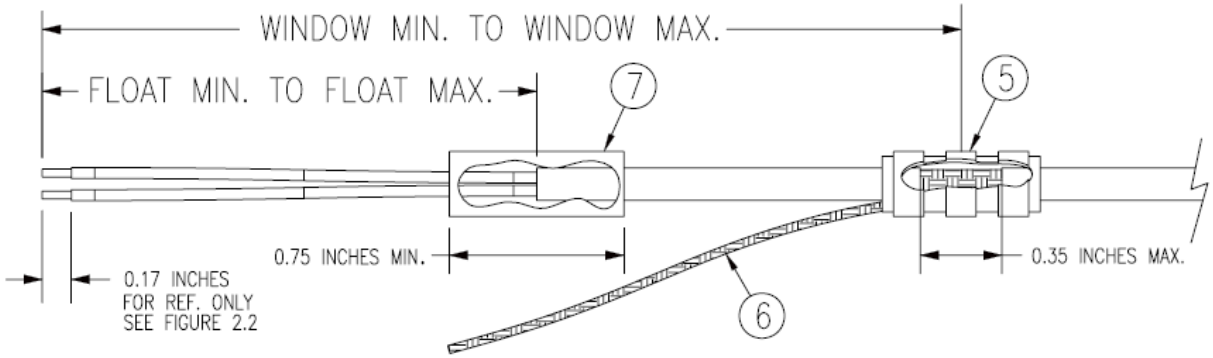


Figure B-16. Standard Shield Termination

Table B-11. Shielded Cable Preparations for Garmin Connectors

Backshell Size	Insert Arrangement	Float (in)			Window (in)		
		Min	Max	Ideal	Min	Max	Ideal
14	19	1.35	1.60	1.50	2.10	4.60	3.60

1. At one end of a shielded cable (item 4) measure a distance between "Window Min" to "Window Max" (Table B-11) and cut a window (max size 0.35") in the jacket to expose the shield (Figure B-16). Use caution when cutting the jacket to avoid damaging the individual braids of the shield. When dealing with a densely populated connector with many cables, it may prove beneficial to stagger the windows throughout the "Window Min" to "Window Max" range. If staggering is not needed the "Ideal Window" length is recommended.

   Suggested tools to accomplish the window cut:

   - Coaxial Cable Stripper
   - Thermal Stripper
   - Sharp Razor Blade

2. Connect a Flat Braid (item 6) to the shield exposed through the window of the prepared cable assembly (item 4) from step 1. The Flat Braid should go out the front of the termination towards the connector. It is not permitted to exit the rear of the termination and loop back towards the connector (Figure B-16). Make this connection using an approved shield termination technique.

   NOTE

   FAA AC 43.13-1B Chapter 11, Section 8 (Wiring Installation Inspection Requirements) may be a helpful reference for termination techniques.

   Preferred Method

   Slide a solder sleeve (item 5) onto the prepared cable assembly (item 4) and connect the Flat Braid (item 6) to the shield using a heat gun approved for use with solder sleeves. It may prove beneficial to use a solder sleeve with a pre-installed Flat Braid versus having to cut a length of Flat Braid to be used. The chosen size of solder sleeve must accommodate both the number of conductors present in the cable and the Flat Braid (item 6) to be attached.

Recommended Solder Sleeve

A preferred solder sleeve would be the Raychem S03 Series with the thermochromic temperature indicator (S03-02-R-9035-100, S03-03-R-9035-100, S03-04-R-9035-100). These solder sleeves come with a pre-installed braid and effectively take the place of items 5 and 6. For detailed instructions on product use, reference Raychem installation procedure RCPS 100-70.

Raychem recommended heating tools:

- HL1802E
- AA-400 Super Heater
- CV-1981
- MiniRay
- IR-1759

Secondary Method

Solder a flat braid (item 6) to the shield exposed through the window of the prepared cable assembly (item 4). Ensure a solid electrical connection through the use of acceptable soldering practices. Use care to avoid applying excessive heat that burns through the insulation of the center conductors and shorts the shield to the signal wire. Slide a minimum 0.75 inches of Teflon heat shrinkable tubing (item 5) onto the prepared wire assembly and shrink using a heat gun. The chosen size of heat shrinkage tubing must accommodate both the number of conductors present in the cable and the flat braid (item 6) to be attached.

Solder Sleeves:

Reference the following MIL-Specs for solder sleeves.
(M83519/1-1, M83519/1-2, M83519/1-3, M83519/1-4, M83519/1-5)

Flat Braid:

If the preferred Raychem sleeves are not being used, the individual flat braid selected should conform to ASTMB33 for tinned copper and be made up of 36 AWG strands to form an approximately 19-20 AWG equivalent flat braid. A circular mil area range of 1000 to 1300 is required. The number of individual strands in each braid bundle is not specified. (e.g. QQB575F36T062)

Teflon Heat Shrinkable Tubing:

Reference the following MIL-Spec for Teflon heat shrinkable tubing (M23053/5-X-Y).

NOTE

Flat Braid as opposed to insulated wire is specified in order to allow continuing air worthiness by allowing for visual inspection of the conductor.

3. At the same end of the shielded cable (item 4) and ahead of the previous shield termination, strip back “Float Min” to “Float Max” (Table B-11) length of jacket and shield to expose the insulated center conductors (Figure B-16). The “Ideal Float” length may be best to build optimally.

Preferred Method

The jacket and shield should be cut off at the same point so no shield is exposed. Slide 0.75 inches minimum of Teflon heat shrinkable tubing (item 7) onto the cable and use a heat gun to shrink the tubing. The chosen size of heat shrinkage tubing must accommodate the number of conductors present in the cable.

Secondary Method

Leave a max 0.35 inches of shield extending past the jacket. Fold the exposed .35 inches of shield back over the jacket. Slide a solder sleeve (item 7) over the end of the cable and use a heat gun approved for solder sleeves to secure the connection. The chosen size of solder sleeve must accommodate the number of conductors present in the cable.

4. Strip back approximately 0.17 inches of insulation from each wire of the shielded cable (item 4) and crimp a contact (item 2) to each conductor. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-17.

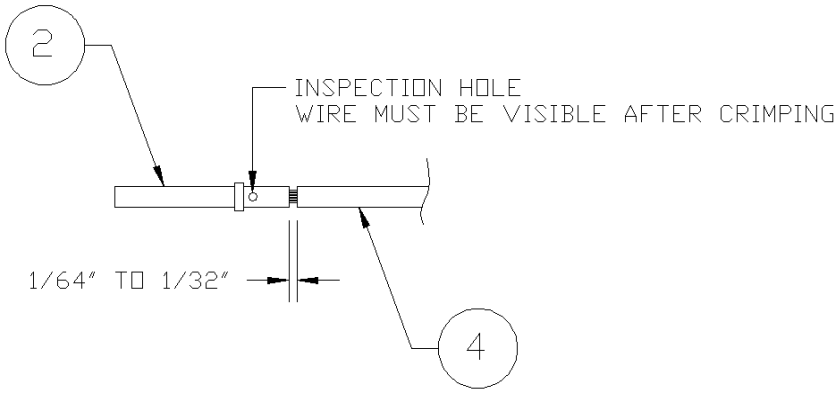


Figure B-17. Insulation/Contact Clearance

5. Insert newly crimped contacts and wires into the appropriate connector housing location as specified by the installation wiring diagrams.
6. Cut the flat braid (item 6) to a length that, with the addition of a ring terminal, will reach the grounding hole of the circular backshell (item 3) (Figure B-15). An appropriate amount of excess length without looping should be given to the flat braid (item 6) to allow it to freely move with the wire bundle.

NOTE

Position the window splice to accommodate a flat braid (item 6) length of no more than 4 inches.

7. Guidelines for terminating the newly cutoff flat braid(s) (item 6) with insulated ring terminals (item 9):
   - The grounding hole on the circular backshell (item 3) may accommodate a max of 4 ring terminals (item 9).
   - It is preferred that only two Flat Braid(s) (item 6) be terminated per ring terminal. Two flat braids per ring terminal will necessitate the use of a #6 ring terminal, 14-16 AWG (MS25036-107).
   - If only a single flat braid is left or if only a single flat braid is needed, a #6 ring terminal, 18-22 AWG (MS25036-102), can accommodate a single flat braid.
   - If more braids exist for this connector than two per ring terminal, it is permissible to terminate three braids per ring terminal. This will necessitate the use of a #6 ring terminal, 10-12 AWG (MS25036-111).
8. Repeat steps 1 through 7 as needed for the remaining shielded cables.
9. Terminate the ring terminals to the circular backshell (item 3) by placing items on the provided pan head screw in the following order: flat washer (provided with circular backshell), first ring terminal, second ring terminal, third ring terminal (if needed) before finally inserting the screw into the grounding hole on the circular backshell and securing with the provided locking nut. Do not violate the guidelines presented in step 7 regarding ring terminals.

B.4.3 Daisy Chain Shield Termination Technique – Method A

In rare situations where more braids need to be terminated for a connector than three per ring terminal it is allowable to daisy chain a maximum of two shields together before coming to the ring terminal (Figure B-18). All other restrictions and instructions for the shield termination technique set forth for Method A.1 are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

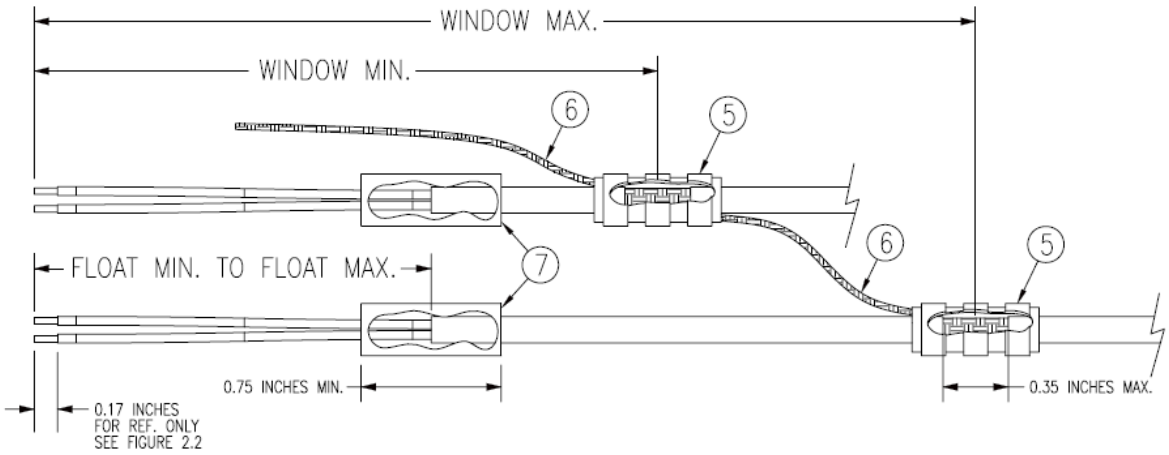


Figure B-18. Daisy Chain Shield Termination

B.4.4 Quick Term Shield Termination – Method B

If desired, the drain wire termination (item 5) and the floating shield termination (item 7) can be effectively combined into a "Quick Term". This method eliminates the float in the cable insulation and moves the placement of the window which was described by the dimensions "Window Min" and "Window Max" from Method A. This technique is depicted in Figure B-19.

NOTE

The original purpose for separating the shield drain termination (item 5) from the float termination (item 7) in Method A was to allow for a variety of lengths for the drain wires so that the shield drain terminations (item 5) would not all "bunch up" in the harness and to eliminate loops in the drain wires. If Method B is chosen, as described in this section, care must be taken to insure that all drain shield terminations can still be inspected. With connectors which require a large number of shield terminations it may be best to use Method A. This will allow the drain shield terminations (item 5) a larger area to be dispersed across.

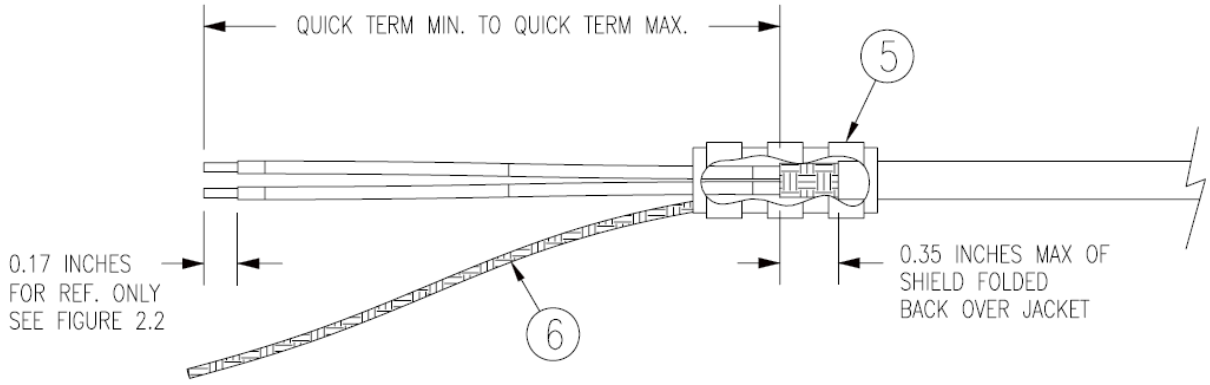


Figure B-19. Quick Term Shield Termination

Table B-12. Shielded Cable Preparations – (Quick Term)

Backshell Size	Insert Arrangement	Quick Term Min (inches)	Quick Term Max (inches)	Quick Term Float (inches)
14	19	1.35	1.60	1.50

1. At the end of the shielded cable (item 4), strip "Quick Term Min" to "Quick Term Max" (Table B-12) length of the jacket to expose the shield. Next trim the shield so that at most 0.35 inches remains extending beyond the insulating jacket. Fold this remaining shield back over the jacket.
2. Connect a flat braid (item 6) to the folded back shield of the prepared cable assembly. The flat braid should go out the front of the termination towards the connector. It is not permitted to exit the rear of the termination and loop back towards the connector (Figure B-19). Make this connection using an approved shield termination technique.

NOTE

FAA AC 43.13-1B Chapter 11, Section 8 (Wiring Installation Inspection Requirements) may be a helpful reference for termination techniques.

Preferred Method

Slide a solder sleeve (item 5) onto the prepared cable assembly (item 4) and connect the flat braid (item 6) to the shield using a heat gun approved for use with solder sleeves. It may prove beneficial to use a solder sleeve with a pre-installed flat braid versus having to cut a length of flat braid to be used. The chosen size of solder sleeve must accommodate both the number of conductors present in the cable and the flat braid (item 6) to be attached.

NOTE

Reference Section B.3.2 for recommended solder sleeves and heating tools. The same recommendations are applicable to this technique.

Secondary Method

Solder a flat braid (item 6) to the folded back shield on the prepared cable assembly (item 4). Ensure a solid electrical connection through the use of acceptable soldering practices. Use care to avoid applying excessive heat that burns through the insulation of the center conductors and shorts the shield to the signal wire. Slide a minimum of 0.75 inches of Teflon heat shrinkable tubing (item 5) onto the prepared wire assembly and shrink using a heat gun. The chosen size of heat shrinkage tubing must accommodate both the number of conductors present in the cable as well as the flat braid (item 6) to be attached.

NOTE

Reference Section B.3.2 for recommended solder sleeves, flat braids, and heat shrinkable tubing. The same recommendations are applicable to this technique.

3. Strip back approximately 0.17 inches of insulation from each wire of the shielded cable (item 4) and crimp a contact (item 2) to each conductor. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-17.
4. Insert newly crimped contacts and wires into the appropriate connector housing location as specified by the installation wiring diagrams.
5. Cut the flat braid (item 6) to a length that, with the addition of a ring terminal, will reach the grounding hole of the circular backshell (item 3) (Figure B-15). An appropriate amount of excess length without looping should be given to the flat braid (item 6) to allow it to freely move with the wire bundle.
6. Guidelines for terminating the newly cutoff flat braid(s) (item 6) with insulated ring terminals (item 9):
   - The grounding hole on the circular backshell (item 3) may accommodate a max of 4 ring terminals (item 9).
   - It is preferred that only two Flat Braid(s) (item 6) be terminated per ring terminal. Two flat braids per ring terminal will necessitate the use of a #6 ring terminal, 14-16 AWG (MS25036-107).
   - If only a single flat braid is left or if only a single flat braid is needed, a #6 ring terminal, 18-22 AWG (MS25036-102), can accommodate a single flat braid.
   - If more braids exist for this connector than two per ring terminal, it is permissible to terminate three braids per ring terminal. This will necessitate the use of a #6 ring terminal, 10-12 AWG (MS25036-111).
7. Repeat steps 1 through 7 as needed for the remaining shielded cables.

8. Terminate the ring terminals to the circular backshell (item 3) by placing items on the provided pan head screw in the following order: flat washer (provided with circular backshell), first ring terminal, second ring terminal, third ring terminal (if needed) before finally inserting the screw into the grounding hole on the circular backshell and securing with the provided locking nut. Do not violate the guidelines presented in step 7 regarding ring terminals.

B.4.5 Daisy Chain, Quick-Term Shield Termination – Method B

In situations where more braids need to be terminated for a connector than three per ring terminal it is allowable to daisy chain a maximum of two shields together before coming to the ring terminal (Figure B-20). All other restrictions and instructions for the shield termination technique set forth for Method B.1 are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

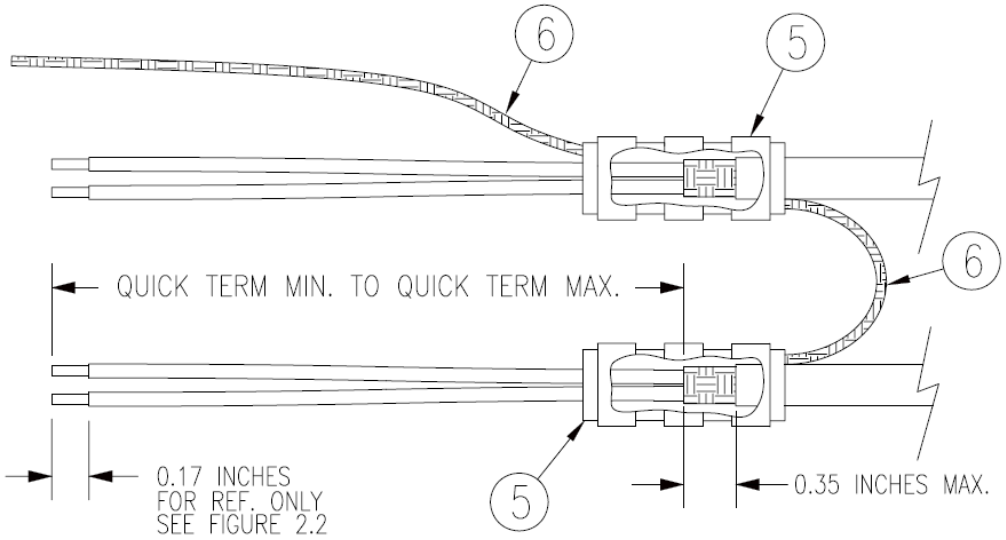


Figure B-20. Daisy Chain, Quick-Term Shield Termination

B.4.6 Daisy Chain Shield Termination Between Methods A and B

In rare situations where more braids need to be terminated for a connector than three per ring terminal and a mixture of Methods A and B have been used, it is allowable to daisy chain a maximum of two shields together from a Method A termination to a Method B (Figure B-21). All other restrictions and instructions for the shield termination technique set forth for Method A and B are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

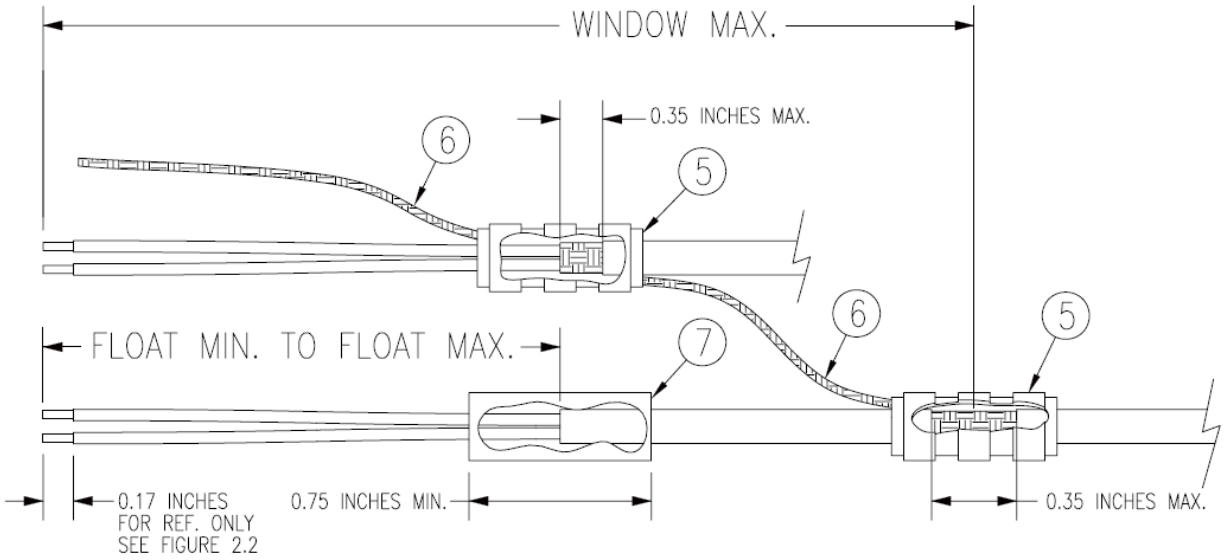
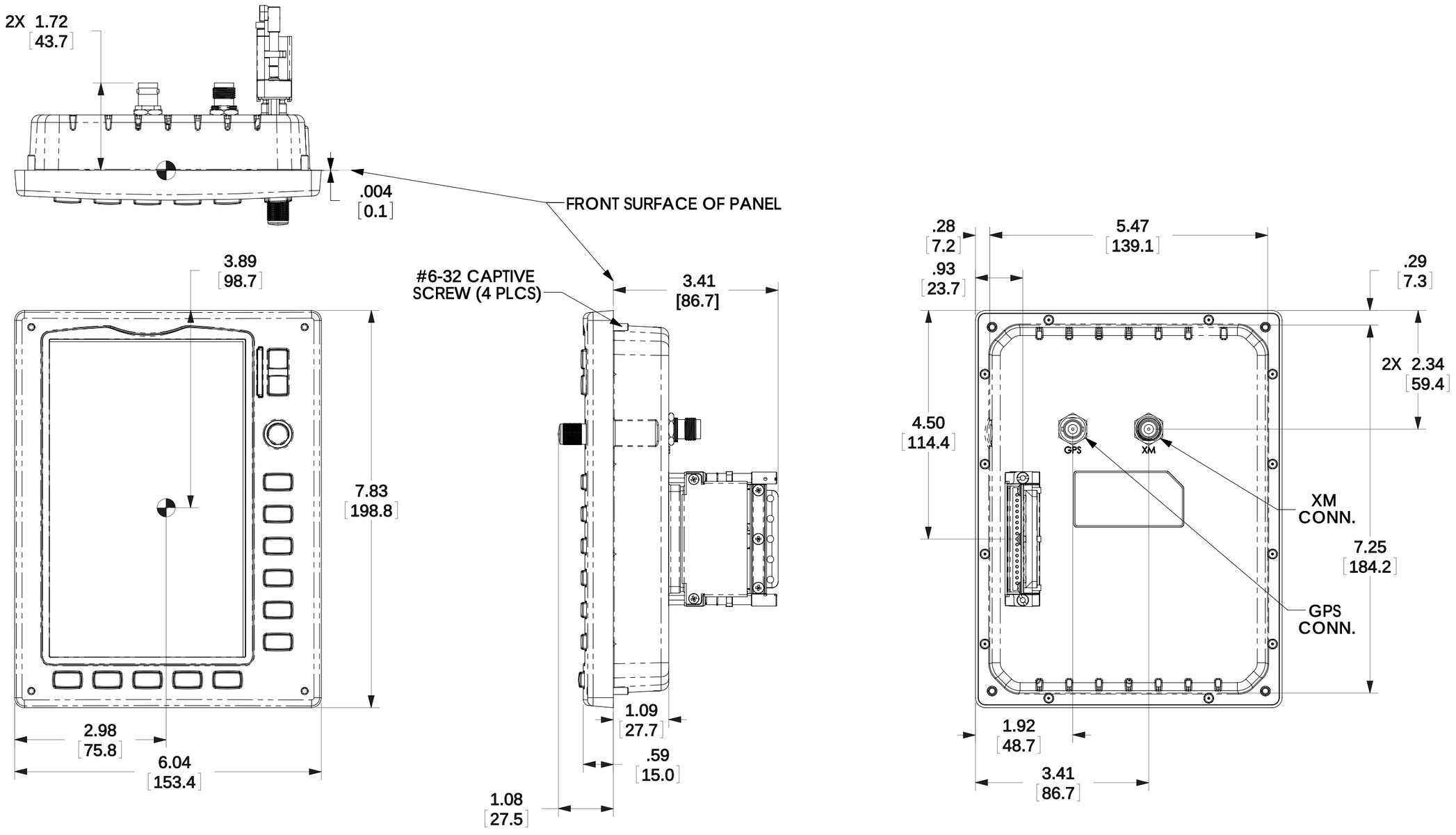
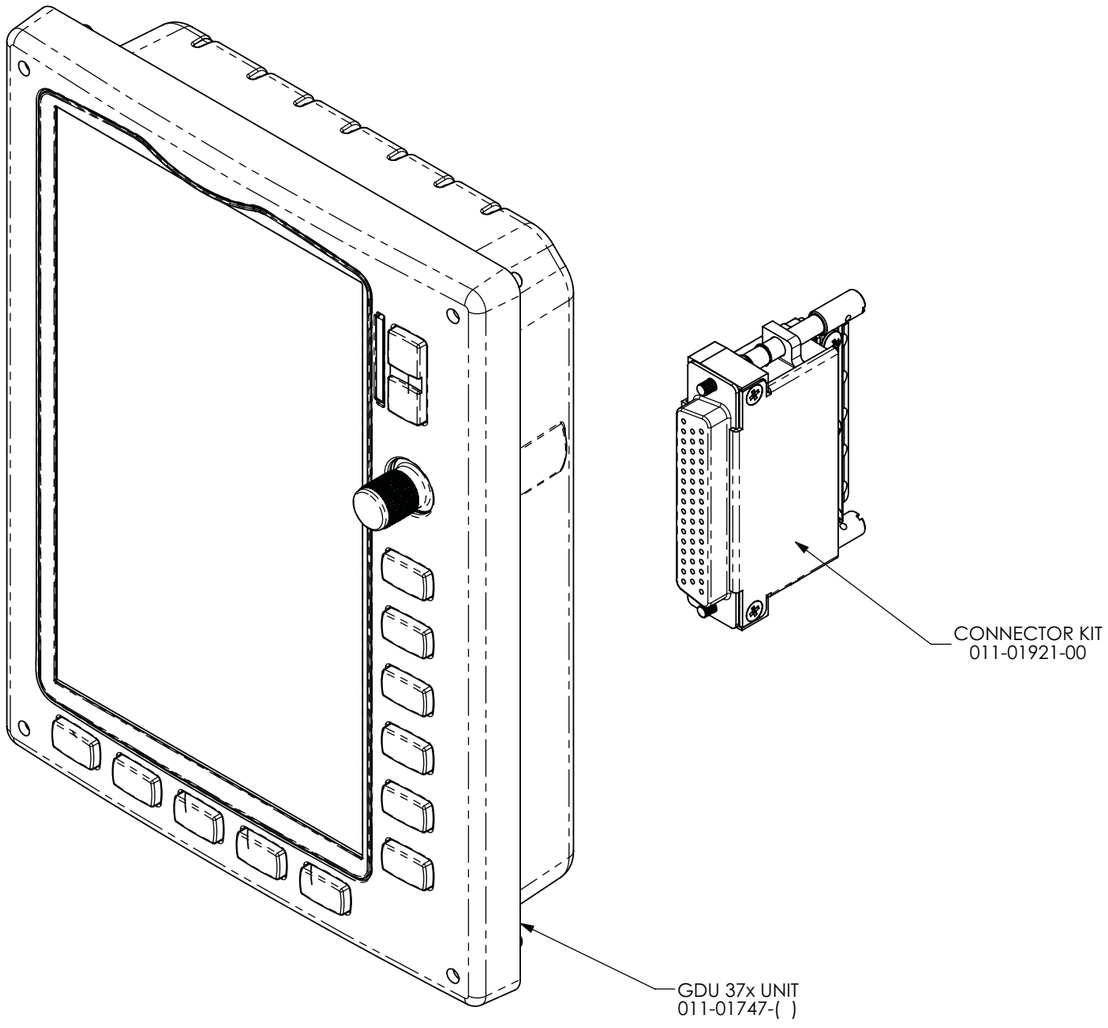


Figure B-21. Daisy Chain Shield Termination between Methods A and B



NOTES:
1. DIMENSIONS: INCHES[MM]
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.

Figure C-1.1 GDU 37X Outline Drawing



Drawing is not to scale! Use for dimensions only.

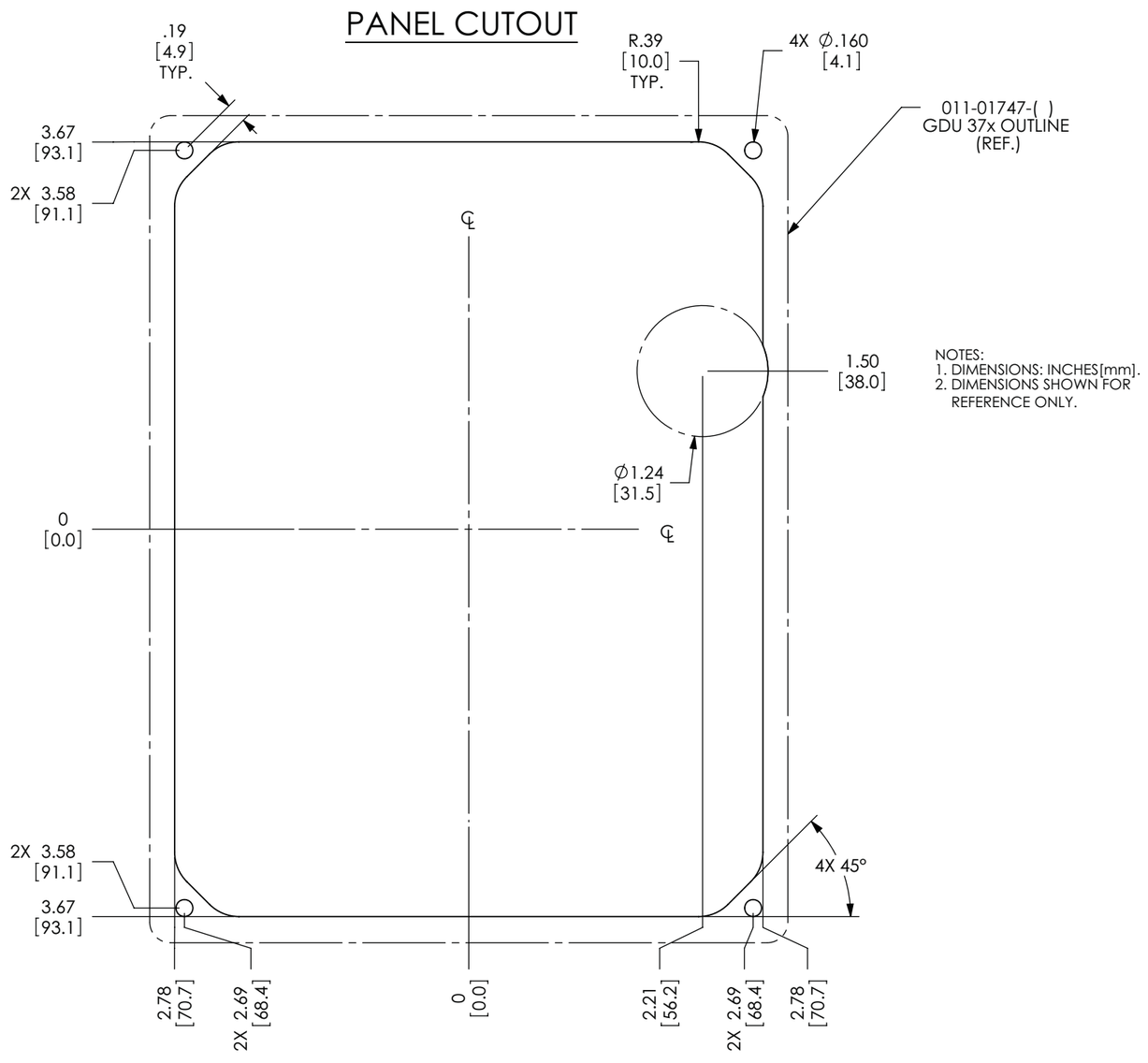
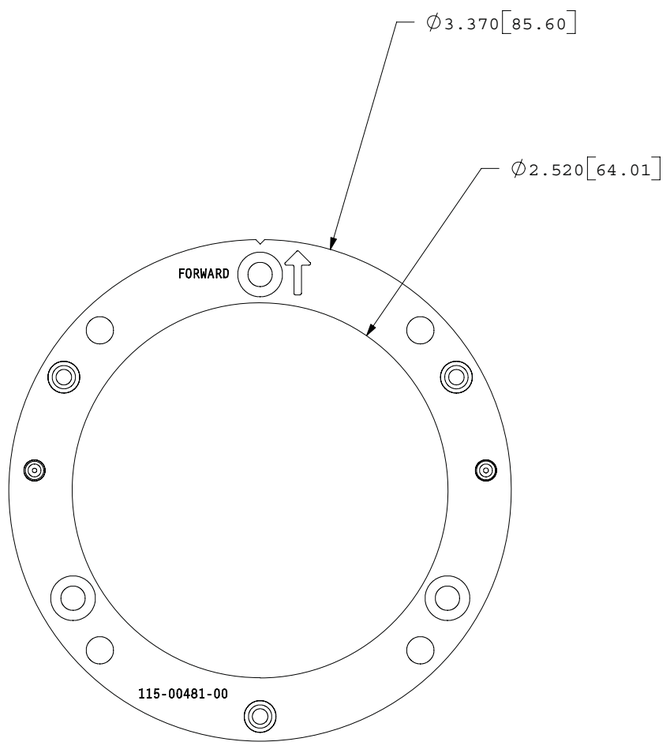
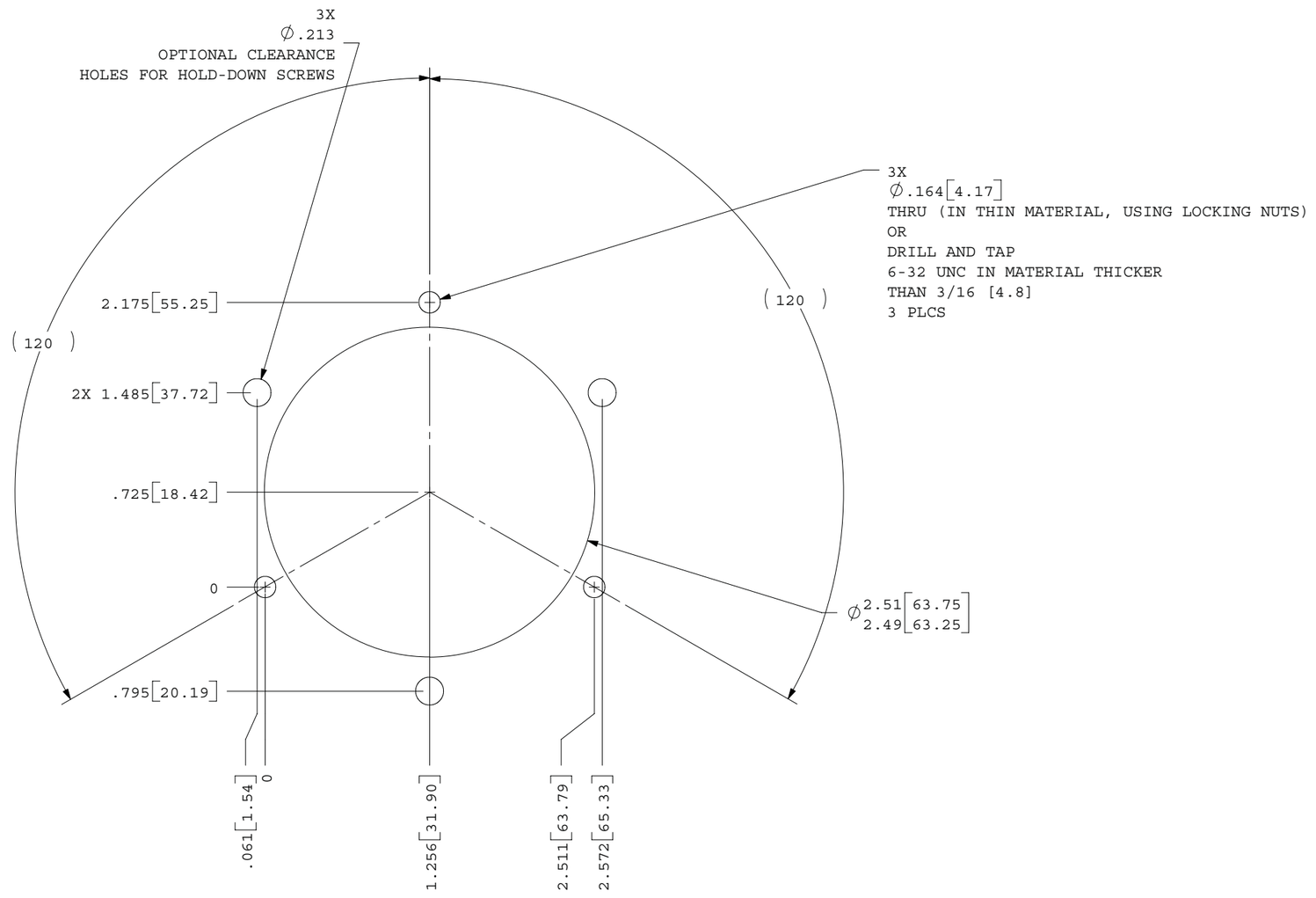


Figure C-1.2 GDU 37X Panel Cutout Drawing

GMU 44 MOUNTING RACK



AIRCRAFT HOLES



NOTE:
1. DIMENSIONS IN INCHES [mm]
2. SEE SECTIONS 3 AND 4 FOR MOUNTING INSTRUCTIONS OF THE GSU 73 AHRS AND GMU 44 MAGNETOMETER UNIT.
3. FOLLOW "FORWARD" AND "TOP" INDICATIONS ON UNIT AND RACK.

Figure C-2.1 GMU 44 Mounting Rack

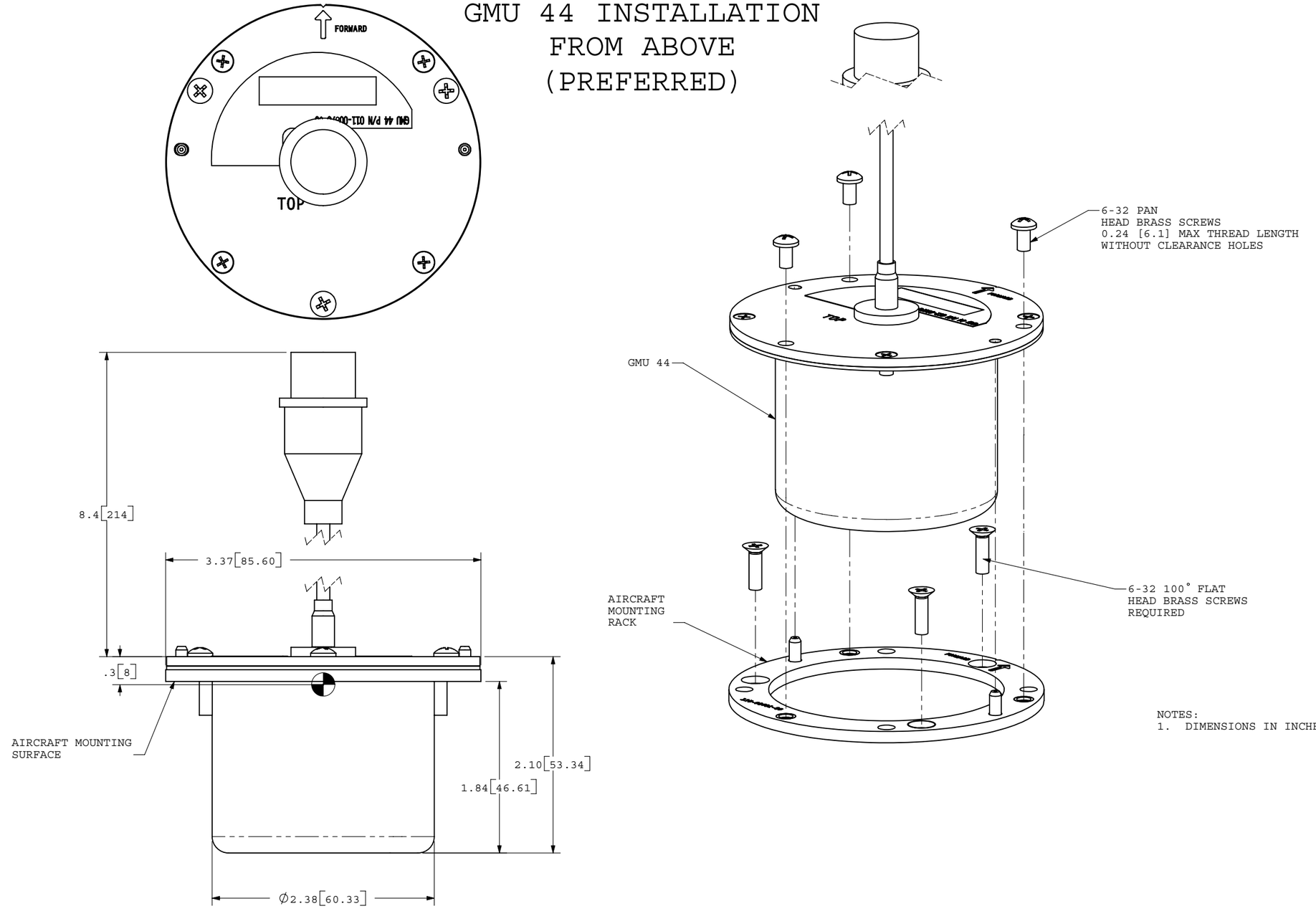


Figure C-2.2. GMU 44 Top Mounted Installation

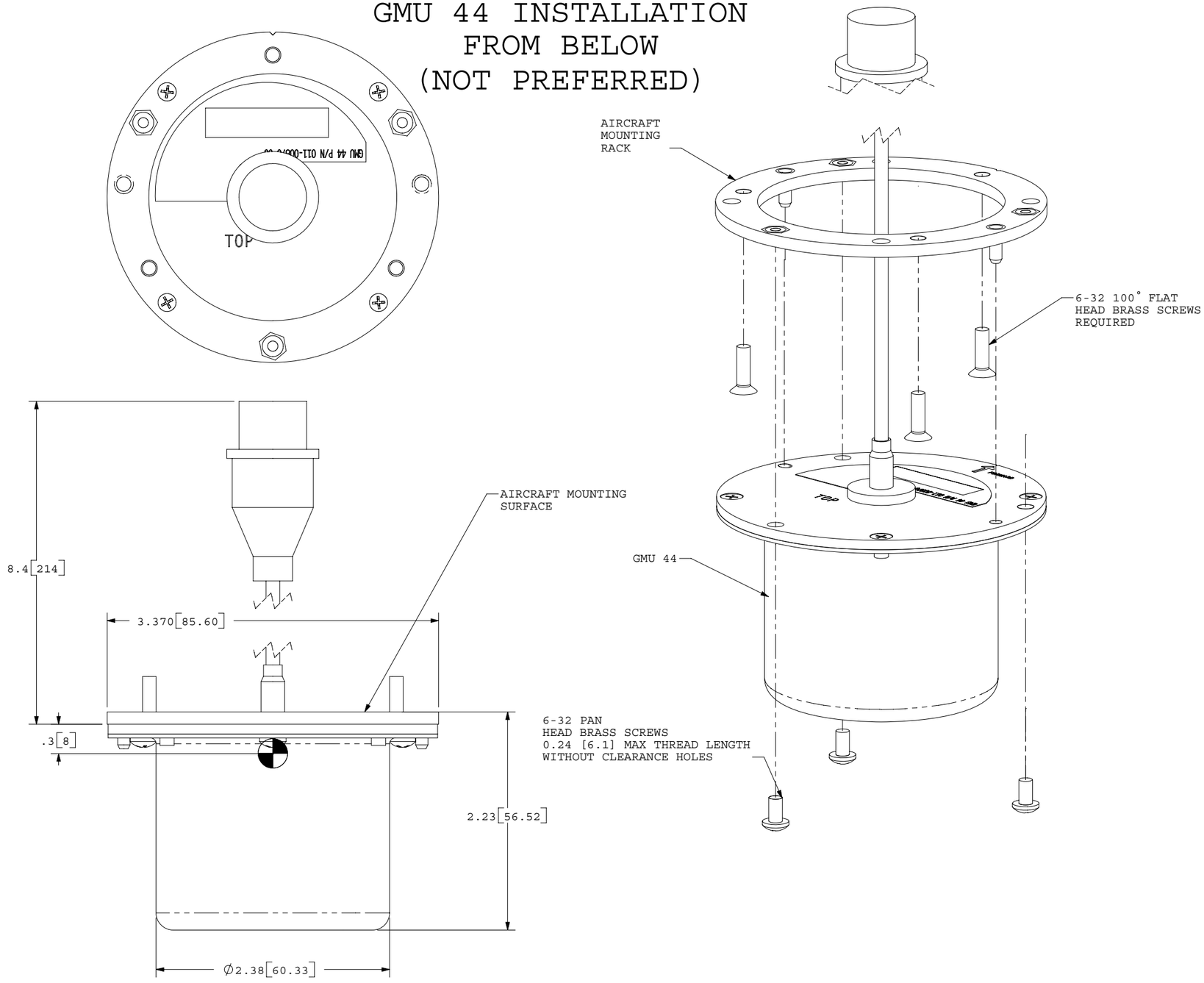


Figure C-2.3 GMU 44 Bottom Mounted Installation

NOTE:

1. BUBBLE NUMBERS IN THIS DRAWING REFER TO REFERENCE NUMBERS LISTED IN TABLES 3-6 AND 3-7.

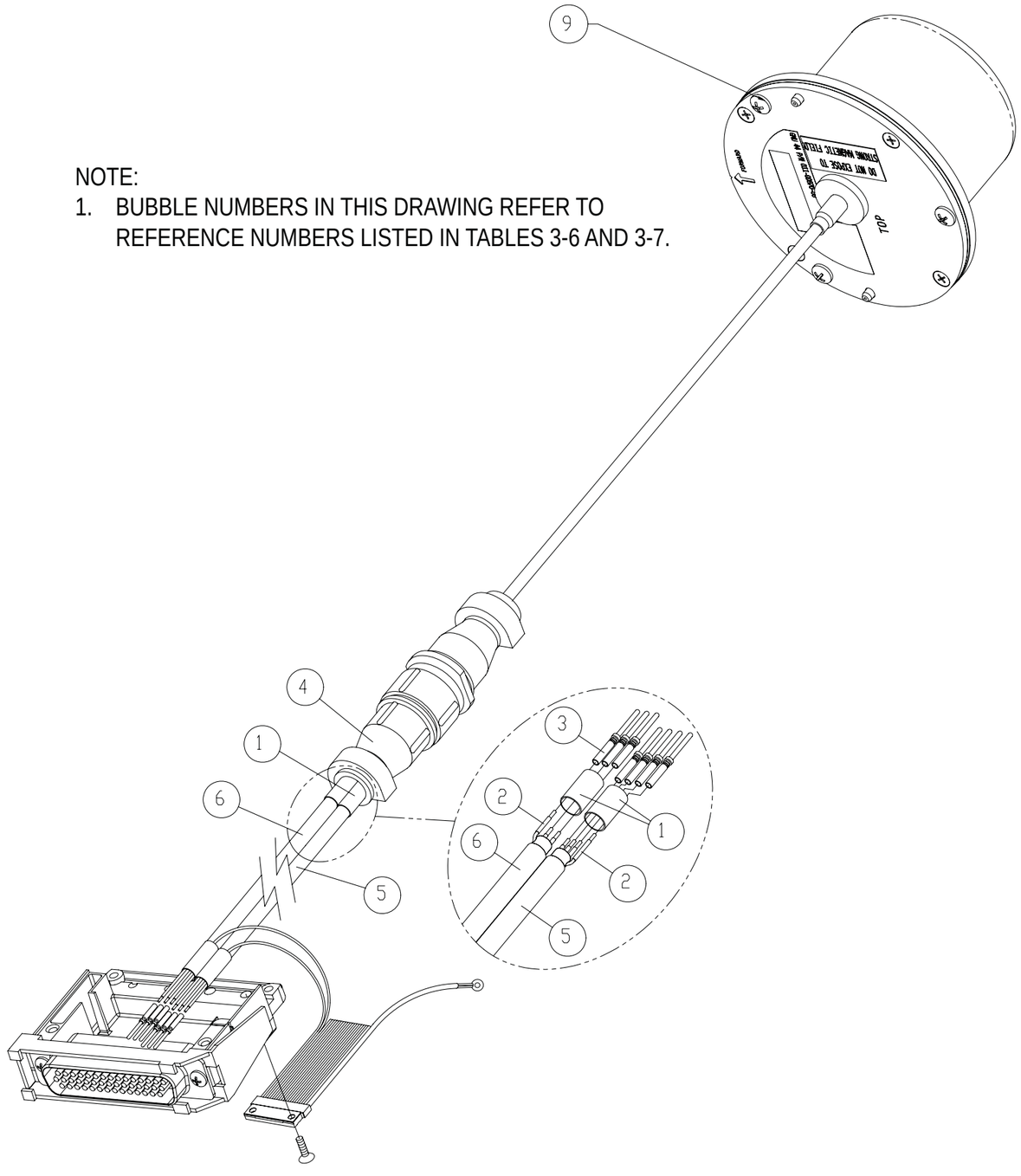
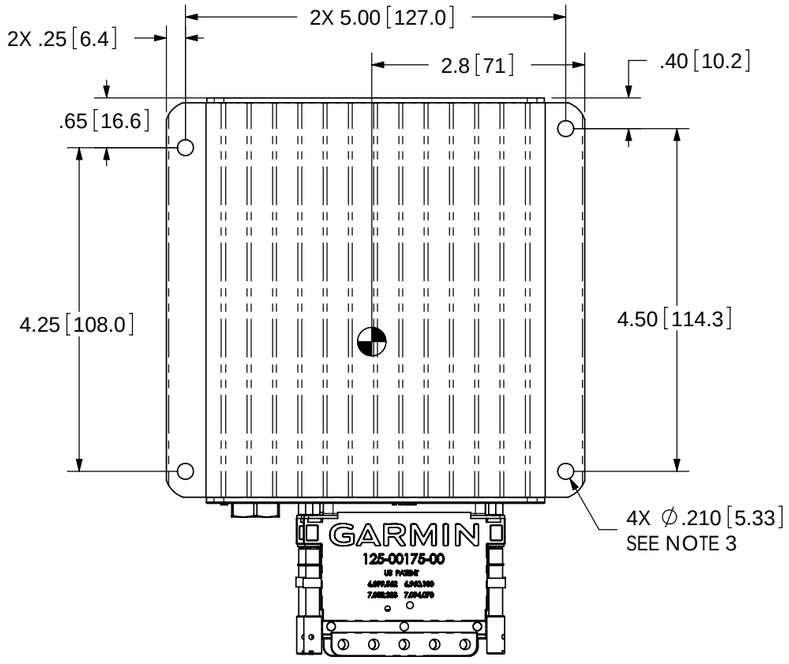
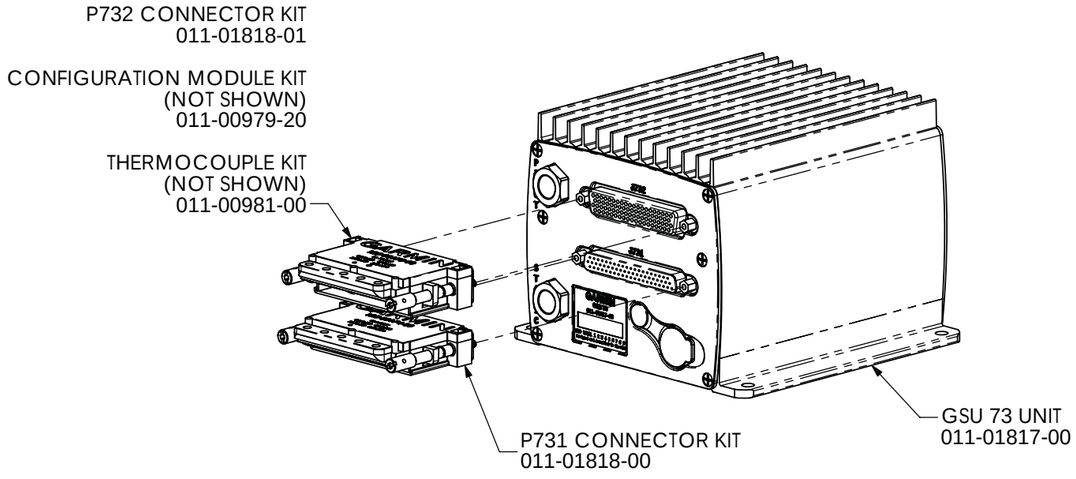
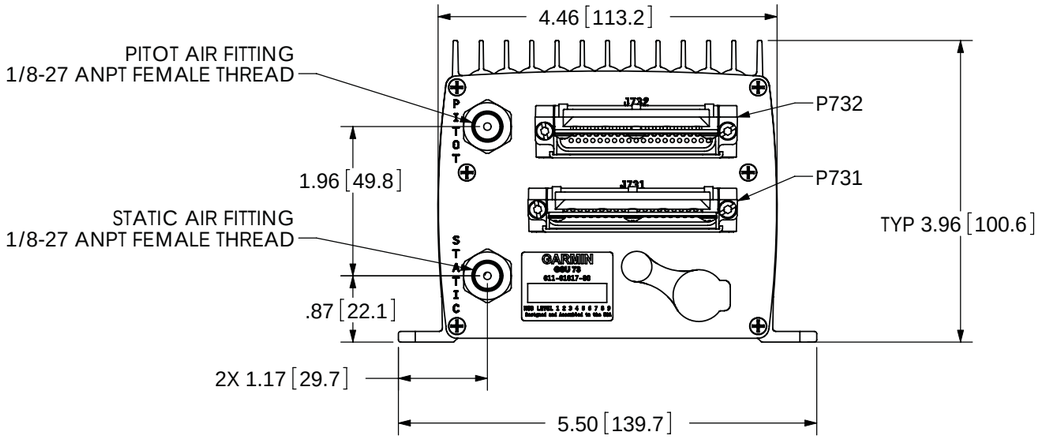
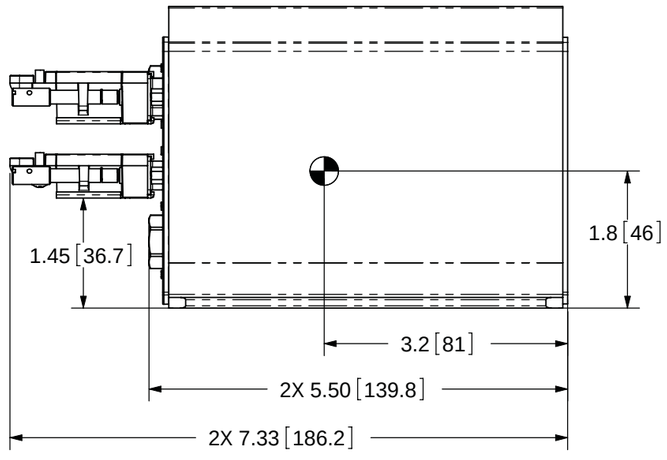


Figure C-2.4 GMU 44 Wiring Detail



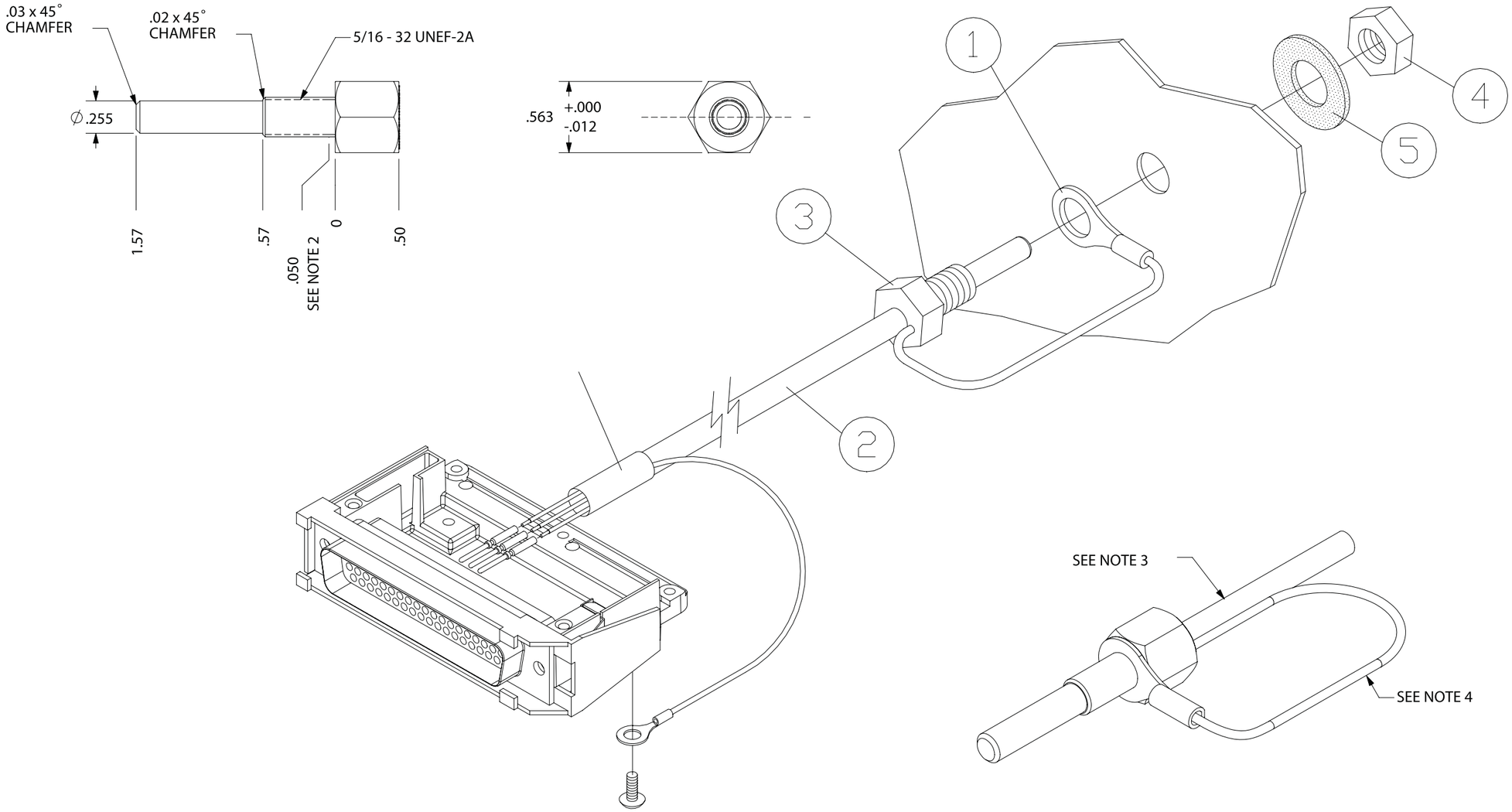






NOTES:
1. DIMENSIONS: INCHES[mm].
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.
3. MOUNTING HOLES FOR #10 PAN HEAD OR HEX HEAD FASTENERS.
4. CENTER OF GRAVITY LOCATION INCLUDES UNIT WITH CONNECTOR KITS.

Figure C-3.1 GSU 73 Outline Drawing

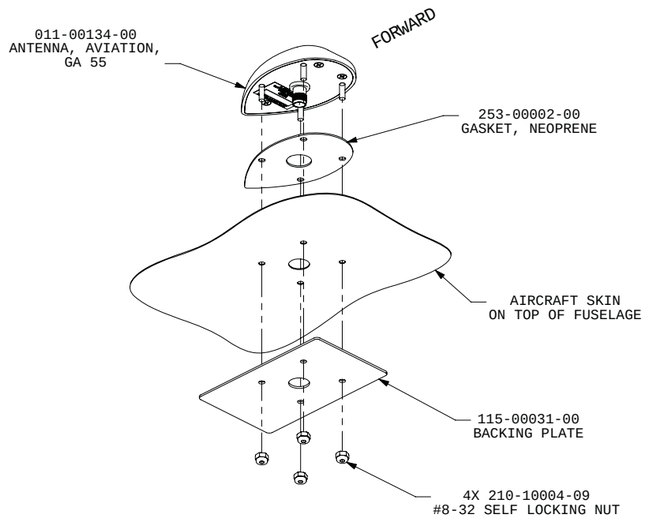


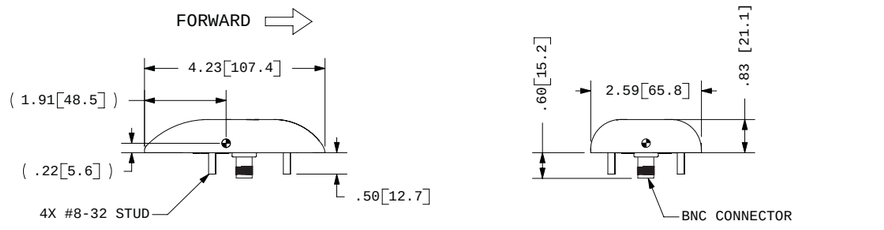
NOTES:

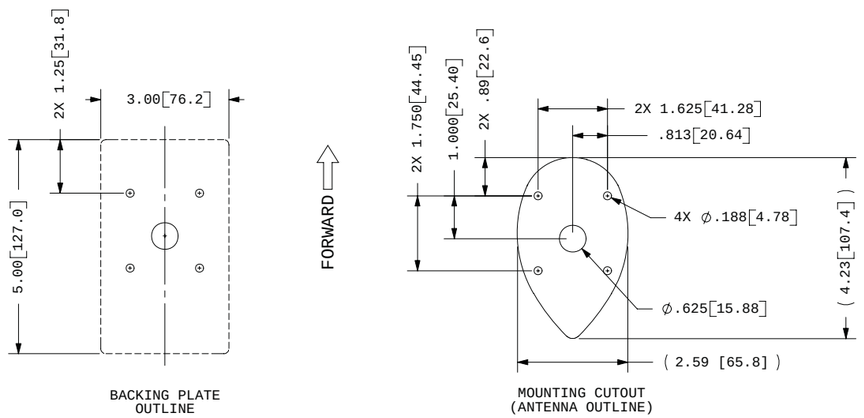
1. DIMENSIONS: INCHES
2. MAX HEIGHT OF INCOMPLETE THREAD: 0.050
3. CABLE: M27500-22TE3V14. CABLE LENGTH TO BE 10 FEET ± 6 INCHES
4. 16 AWG WIRE: M22759/16-16. LENGTH OF WIRE OUTSIDE OF CASE TO BE 3.5 INCHES +0.25, -0.
5. SOLDER TERMINAL: MS25036-109
6. SHIELD OF CABLE ELECTRICALLY CONNECTED TO 16 AWG WIRE.
7. BUBBLE NUMBERS IN THIS DRAWING REFER TO REFERENCE NUMBERS LISTED IN TABLE 5-3.

Figure C-4.1 GTP 59 O.A.T. Probe Installation Drawing

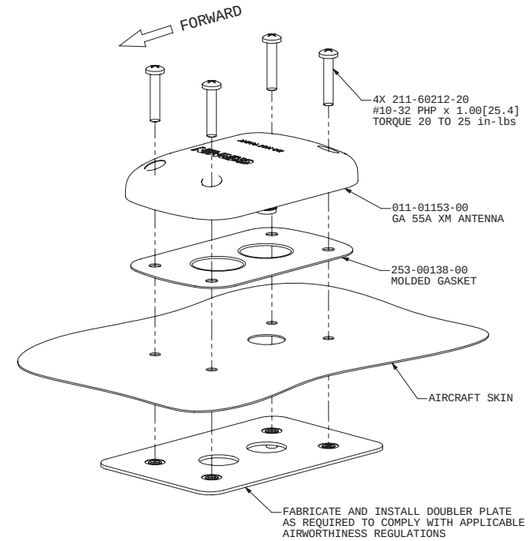
GA 55 STUD MOUNT

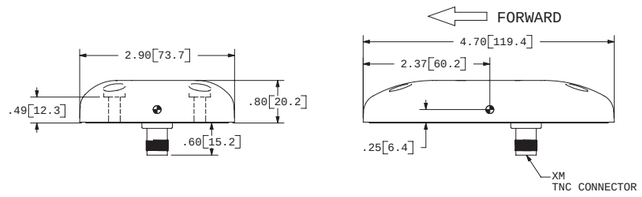


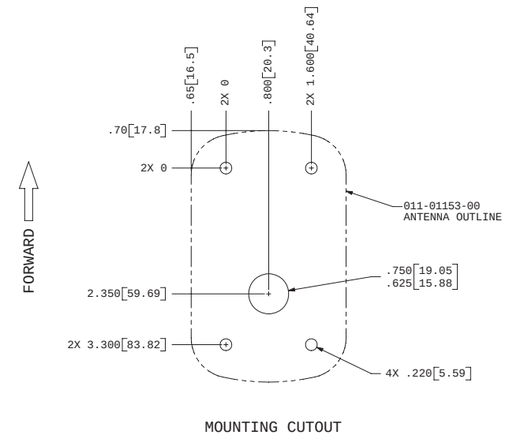




GA 55A FLANGE MOUNT







NOTES:
1. DIMENSIONS: INCHES[mm]

Figure C-5.1 GA 55/55A Installation Drawing

GA 56 STUD MOUNT

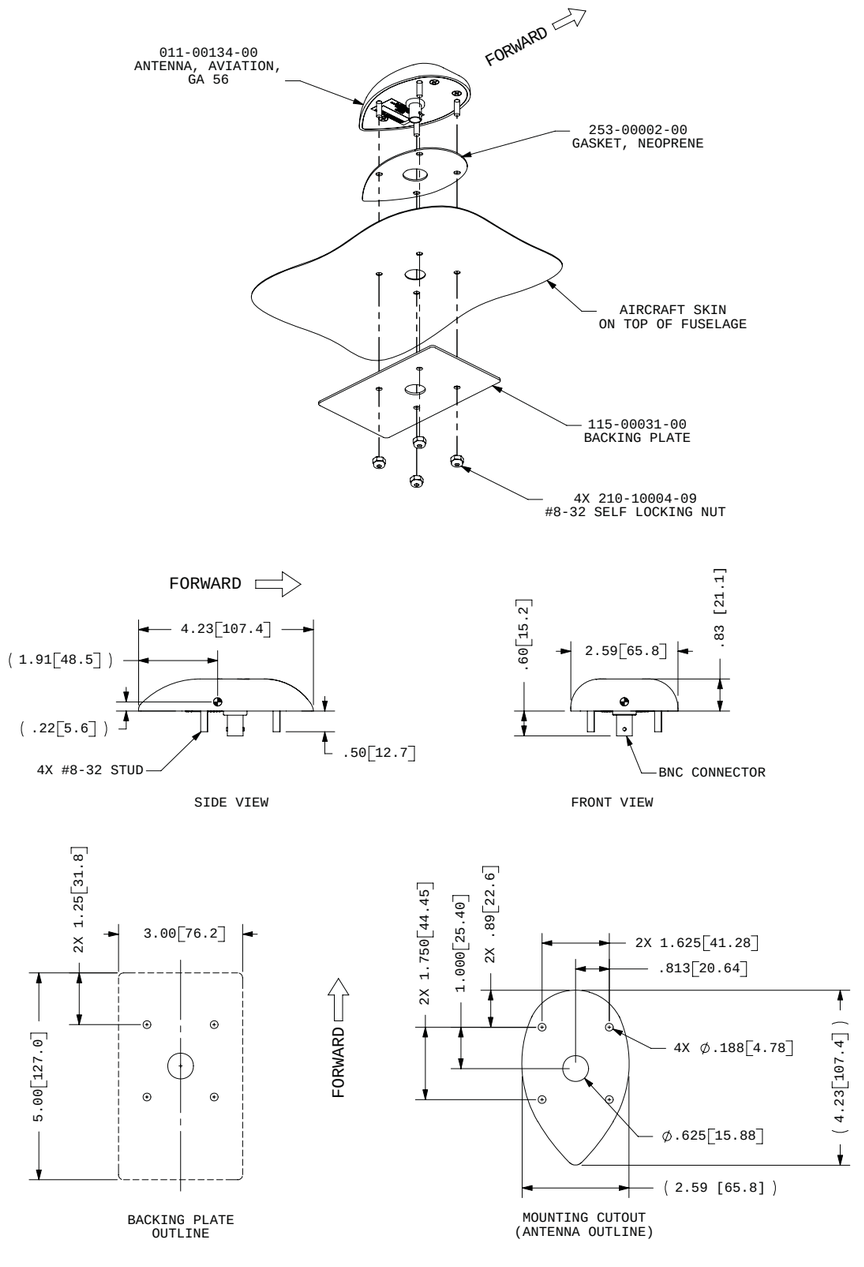
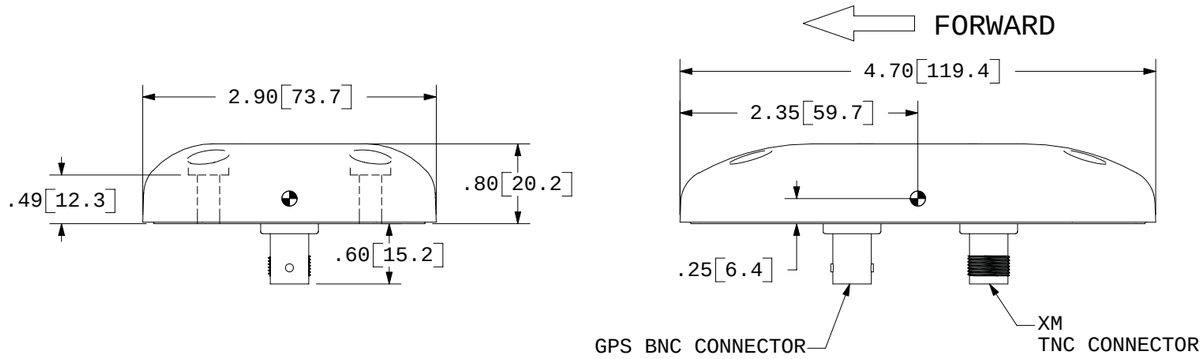
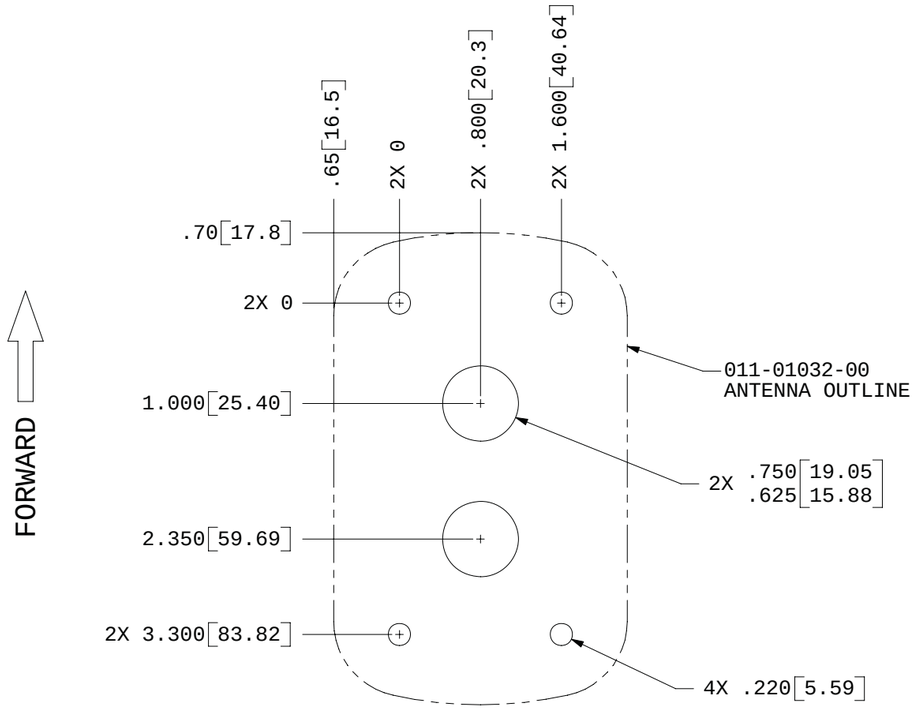
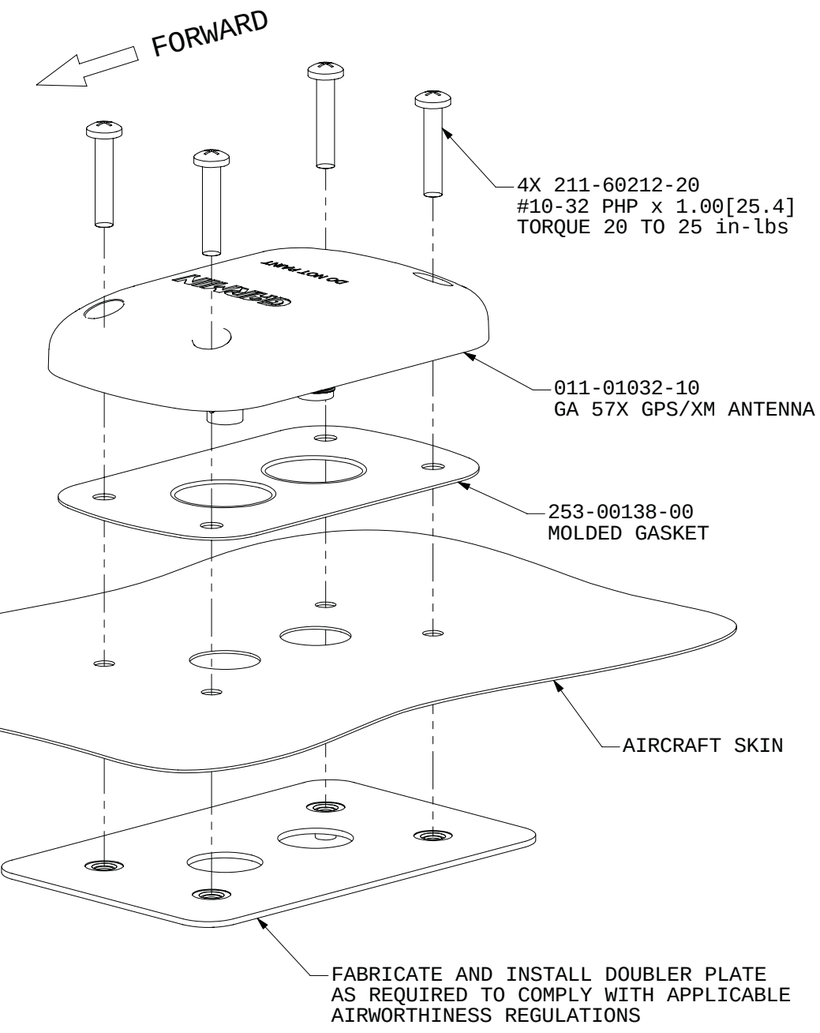


Figure C-5.2 GA 56 Installation Drawing





MOUNTING CUTOUT

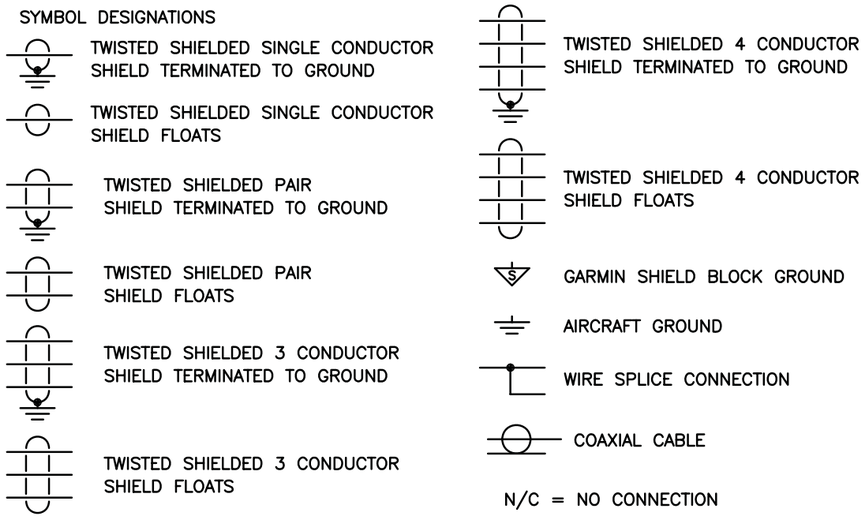


NOTES:
1. DIMENSIONS: INCHES[mm]

Figure C-5.3. GA 57X Installation Drawing

NOTES:

1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL–W–22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL–C–27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM.
4. SYMBOL DESIGNATIONS



5. UNLESS OTHERWISE NOTED, ALL SHIELD GROUNDS MUST BE MADE TO THE RESPECTIVE UNIT BACKSHELLS. ALL OTHER GROUNDS SHOULD BE TERMINATED TO AIRCRAFT GROUND AS CLOSE TO THE RESPECTIVE UNIT AS POSSIBLE.
6. WIRE COLORS ARE NOTED FOR ADVISORY PURPOSES ONLY, EXCEPT FOR THE CONFIG MODULE AND GTP 59.
8. INSTALLATION INSTRUCTIONS FOR OAT PROBE, GMU 44, GND HARNESS, CONFIGURATION MODULES AND THERMOCOUPLES ARE PROVIDED IN THE G3X INSTALLATION MANUAL.
9. RESERVED.
10. OPTIONAL INTERFACE.
11. THE GDU 37X CAN BE CONFIGURED TO ACCEPT A 14V OR 28V LIGHTING BUS INPUT. SEE THE G3X INSTALLATION MANUAL FOR DETAILS ON CONFIGURATION AND SETUP OF A LIGHTING CURVE.
12. ONLY ONE GDU 37X GPS ANTENNA CONNECTION IS REQUIRED FOR THE G3X SYSTEM. ADDITIONAL ANTENNAS CAN BE ADDED FOR REDUNDANCY IF DESIRED. SEE THE G3X INSTALLATION MANUAL FOR DETAILS REGARDING GDU 37X GPS ANTENNA CONFIGURATION.
13. THE CAN BUS SHOULD ONLY BE TERMINATED AT ONE GDU 37X.

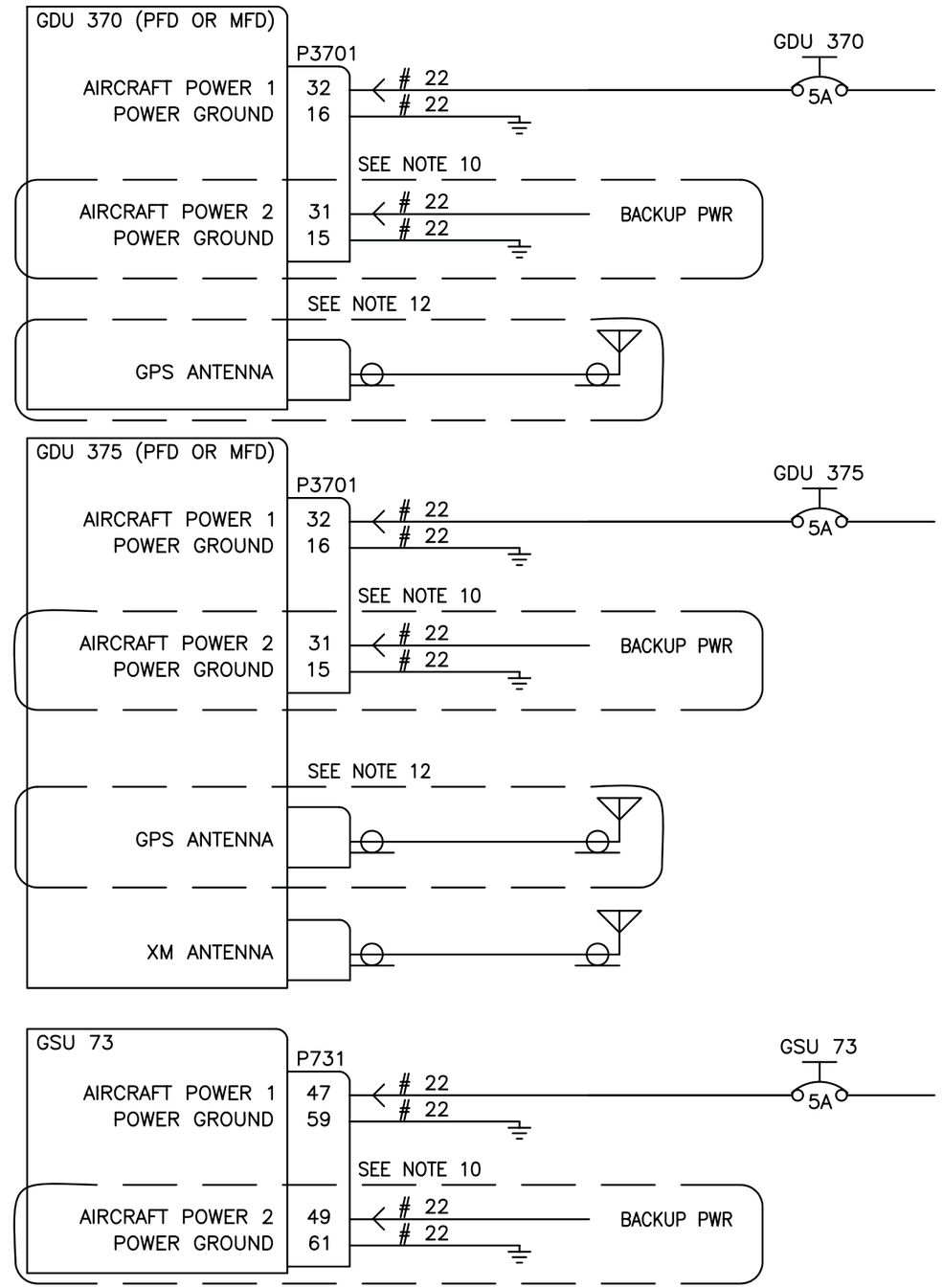


Figure D-1.1 Notes, 14V Power, and Antennas

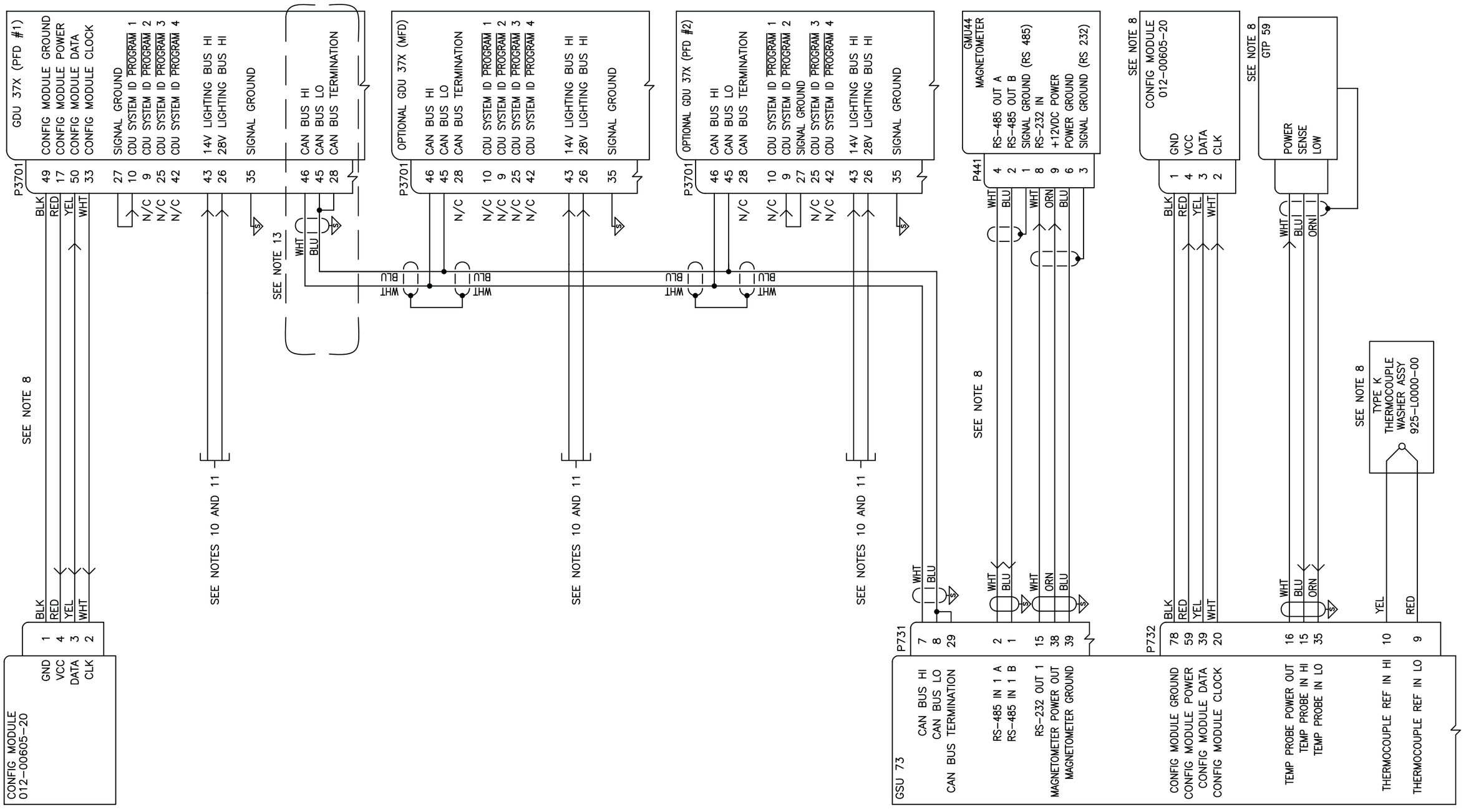


Figure D-1.2 GDU 37X and GSU 73

NOTES:

1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM.
4. SYMBOL DESIGNATIONS

   TWISTED SHIELDED SINGLE CONDUCTOR SHIELD TERMINATED TO GROUND

   TWISTED SHIELDED SINGLE CONDUCTOR SHIELD FLOATS

   TWISTED SHIELDED PAIR SHIELD TERMINATED TO GROUND

   TWISTED SHIELDED PAIR SHIELD FLOATS

   TWISTED SHIELDED 3 CONDUCTOR SHIELD TERMINATED TO GROUND

   TWISTED SHIELDED 3 CONDUCTOR SHIELD FLOATS

   TWISTED SHIELDED 4 CONDUCTOR SHIELD TERMINATED TO GROUND

   TWISTED SHIELDED 4 CONDUCTOR SHIELD FLOATS

   GARMIN SHIELD BLOCK GROUND

   AIRCRAFT GROUND

   WIRE SPLICE CONNECTION

   COAXIAL CABLE

   N/C = NO CONNECTION

5. UNLESS OTHERWISE NOTED, ALL SHIELD GROUNDS MUST BE MADE TO THE RESPECTIVE UNIT BACKSHELLS. ALL OTHER GROUNDS SHOULD BE TERMINATED TO AIRCRAFT GROUND AS CLOSE TO THE RESPECTIVE UNIT AS POSSIBLE.
6. RESERVED.
7. AT THIS TIME THE RS-232 INTERFACE FROM GNS 400/500 SERIES SUPPORTS FLIGHT PLAN DATA TRANSFER. TRANSFER OF HSI INFO FROM AN EXTERNAL NAV SOURCE WILL BE SUPPORTED VIA PROVISIONAL WIRING AND FUTURE SOFTWARE UPDATES. GDU 37X RS-232 OUTPUTS SHOWN HERE ALLOW FREQUENCIES TO BE TRANSFERRED FROM THE GDU 37X TO THE CONNECTED NAV/COM OR NMEA DATA TO BE PASSED TO A SERIAL AUTOPILOT OR ELT DEVICE. RS-232 INPUT/OUTPUT LINES CAN ONLY BE CONNECTED TO ONE DEVICE AT A TIME. RS-232 CHANNEL ASSIGNMENTS ARE SHOWN FOR REFERENCE ONLY. CONNECTIONS CAN BE REASSIGNED TO DIFFERENT CHANNELS OR TO CHANNELS ON AN OPTIONAL SECOND OR THIRD DISPLAY. SEE THE G3X INSTALLATION MANUAL FOR RS-232 INPUT/OUTPUT CONFIGURATION GUIDANCE.
8. PROVISIONAL INTERCONNECT SHOWN TO SUPPORT FUTURE ENHANCEMENTS. DETAILS ARE SUBJECT TO CHANGE.
9. REFERENCE SHEET 4 FOR MORE DETAILED INFORMATION ON CONNECTION OF THIRD PARTY AUTOPILOTS.
10. AIR DATA AND GPS INFORMATION OUTPUT TO THE TRANSPONDER.
11. OPTIONAL INTERFACE.
12. THE GMA 240 IS SHOWN HERE FOR REFERENCE ONLY. OTHER INTERCOM/AUDIO PANEL PRODUCTS MAY BE COMPATIBLE WITH THE GDU 37X. THE ALERTS GENERATED BY THE GDU 37X CAN BE CONFIGURED TO TRANSMIT ON MONO AND STEREO AUDIO LINES OR MONO ONLY. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL DETAILS ON CONFIGURATION OF THE GDU 37X ALERT OUTPUT.

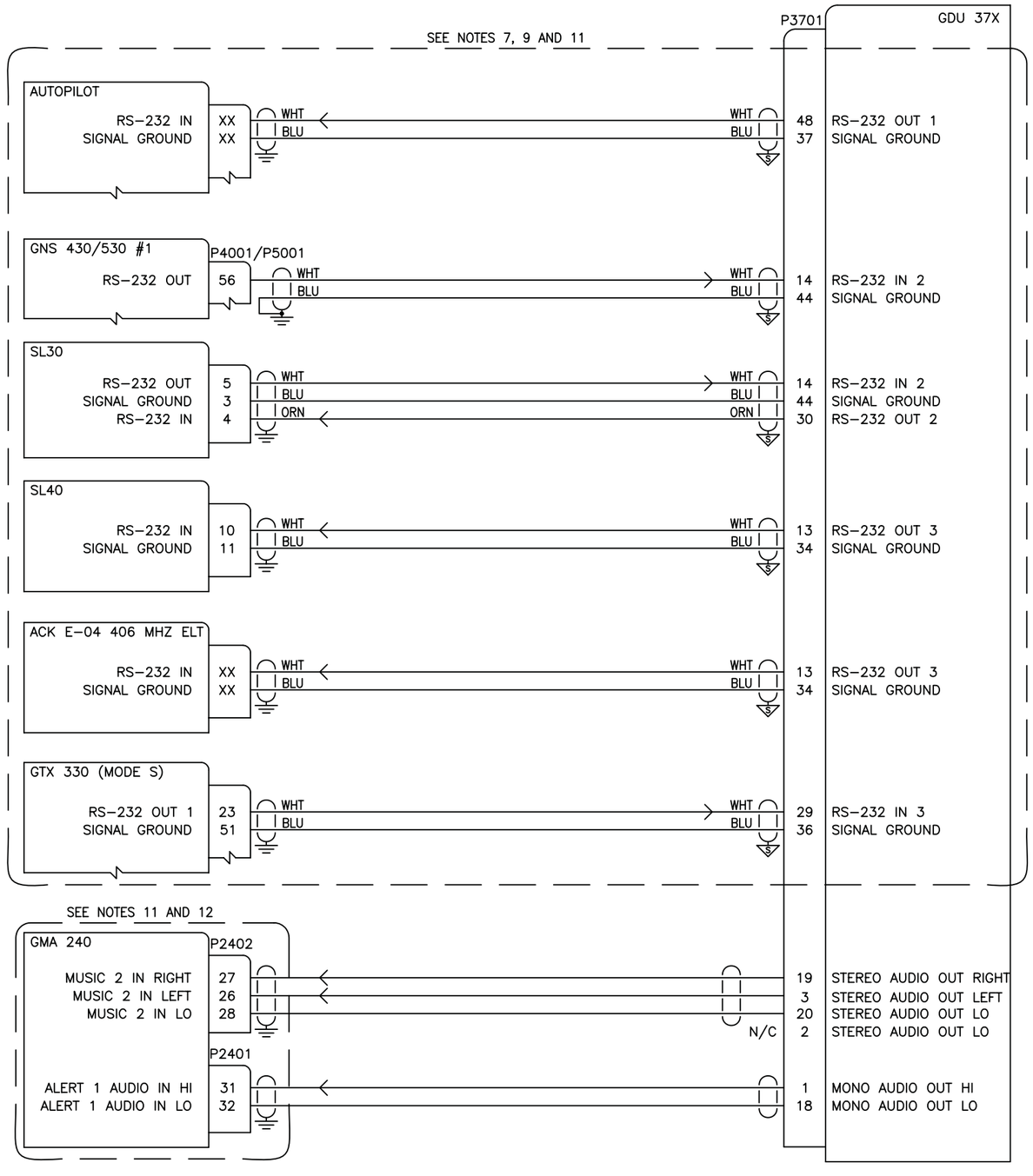


Figure E-1.1 Notes, GDU 37X RS-232 and Audio Examples

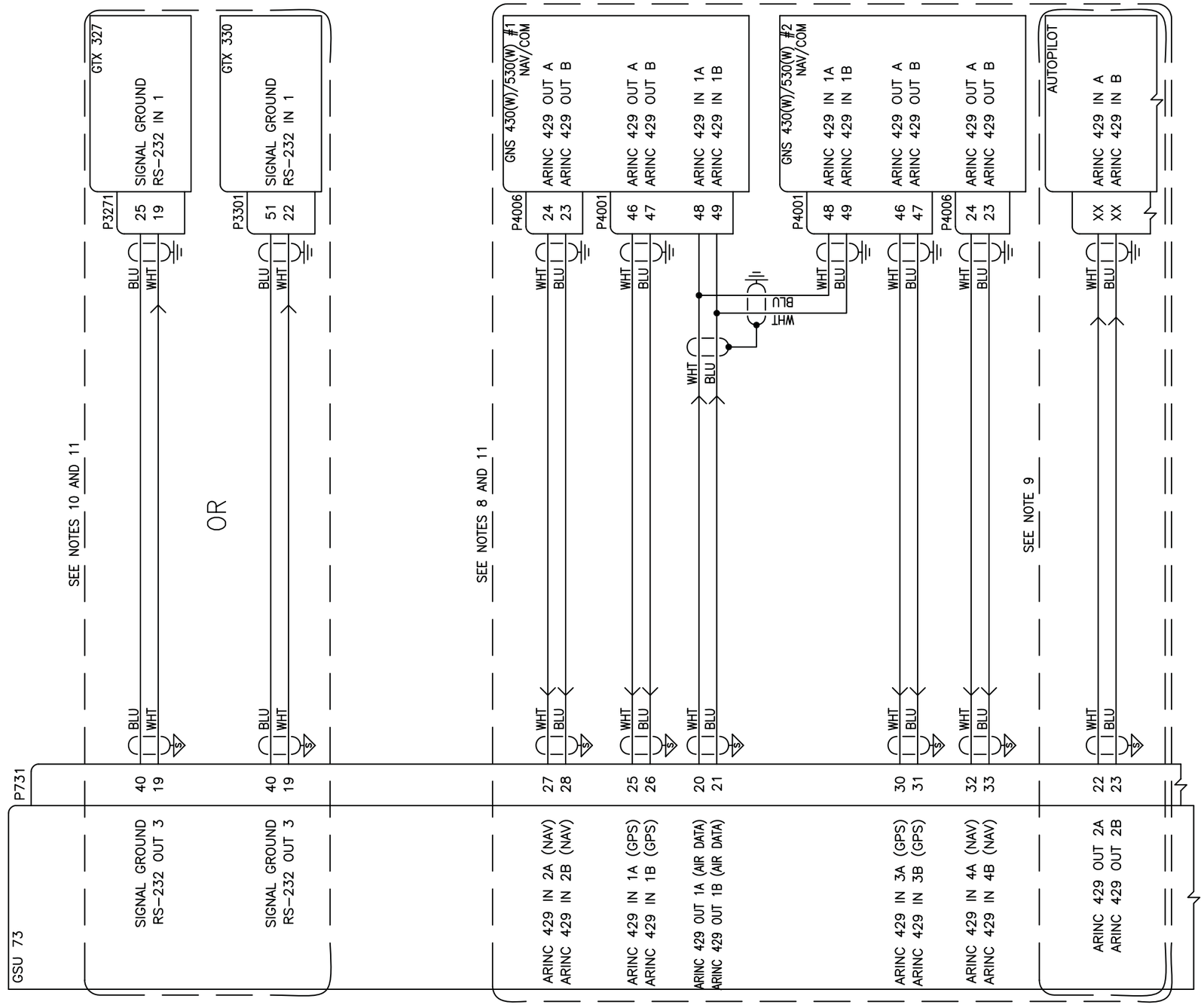


Figure E-1.2 GSU 73 RS-232 and ARINC 429 Examples

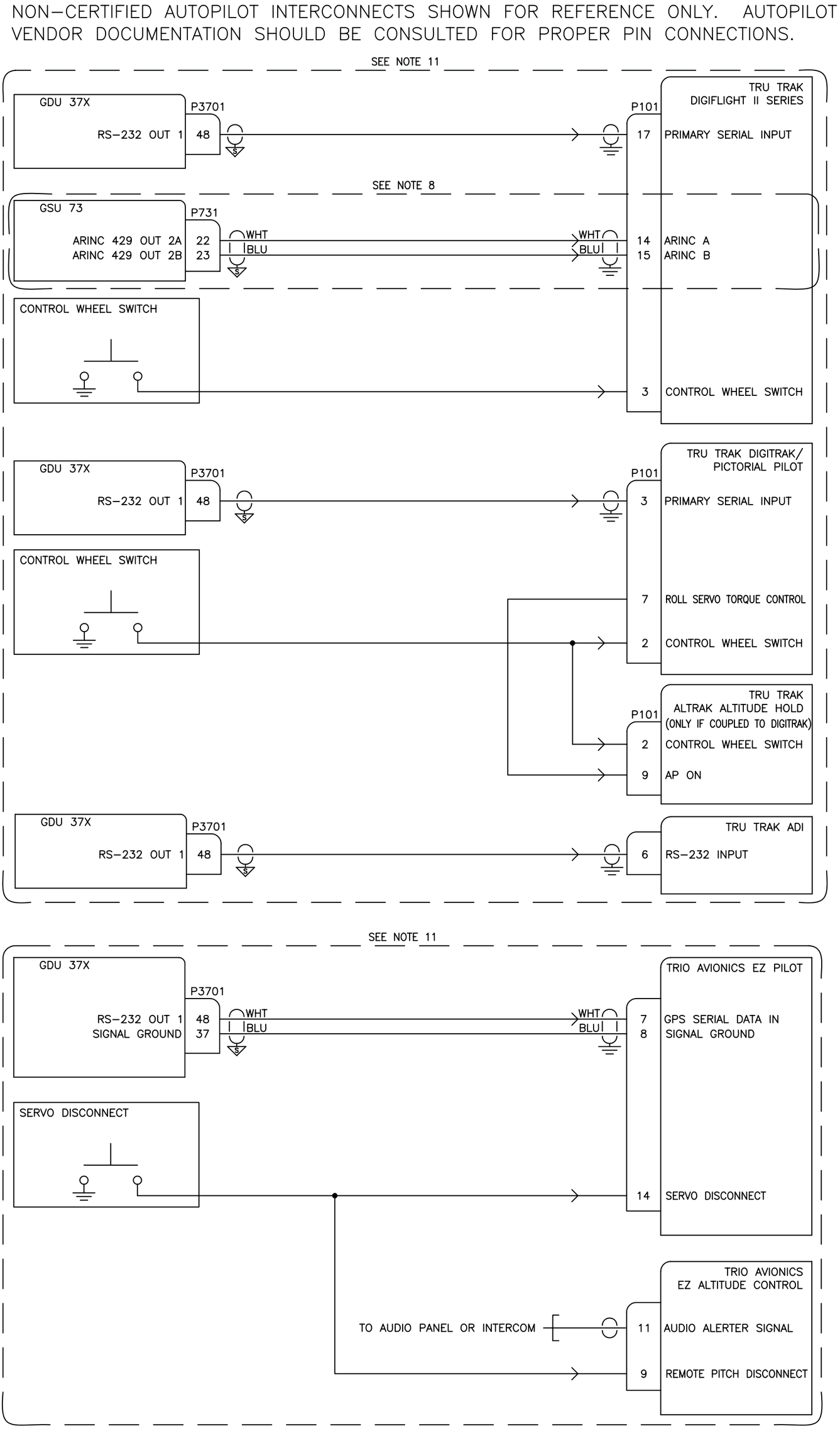


Figure E-1.3 Tru Trak and Trio Auto Pilot Examples